



June 9, 2016

Mr. Vincent P. Bertoni
Director of City Planning
Department of City Planning
200 North Spring Street
Los Angeles, California 90012-2601

Re: Petition for Abatement of Public Nuisance
Address: 1349-1375 Jefferson Blvd., Los Angeles, California 90007

Dear Mr. Bertoni:

Earthjustice submits this petition on behalf of Redeemer Community Partnership, a non-profit grassroots organization whose members strive to create and maintain a safe and healthy environment for families in South Los Angeles. Redeemer Community Partnership requests that you exercise your authority as Director of the City of Los Angeles' Department of City Planning ("Department") to abate the ongoing nuisance at the Jefferson Drill Site under the City of Los Angeles Municipal Code ("LA Code"). The Jefferson Drill Site is located at 1349-1375 Jefferson Boulevard within a densely populated residential area in the City of Los Angeles.

For far too long, the community near the Jefferson Drill Site has been subjected to ongoing nuisance conditions caused by this facility. These violations threaten the community's health and safety, as well as disrupt the peaceful enjoyment of their homes. One example of countless residents experiencing a diminished quality of life involves Myrna Gallardo, who testified about her experience living near the Jefferson Drill Site at a hearing held by the Department on November 25, 2014 to consider a proposal to drill or re-drill three new wells:

"I live two houses away from the site, on the same block. I have 20 years living in this house. Most of the time I have to close all my windows and close the door, the back door also because of the smell. The smell is worse when it's hot, when the sun is very hot. [inaudible]. The noise is very loud when they are working with the machines, and I have children, when they were very young, I had to go outside. I had to go to the library or I had to go to the park because the sound, the noise was very loud that I cannot stay at my home even if I close all the windows. Even today, it's very loud. And I didn't come before because I didn't know somebody can do something for us. Thank you."¹

¹ Transcription of comments of Myrna Gallardo, Hearing of the Office of Zoning Administration, Case Number ZA 17528(PA4) (Nov. 25, 2014).

The City of Los Angeles played an important role in the creation of the nuisance conditions that Myrna Gallardo and countless other nearby residents continue to experience. In 1965 when the Jefferson Drill Site was constructed, the area was already a “solidly”² developed urban area. In fact, “at the behest of the Department of Building and Safety” homes and businesses were removed to make “an open area available for this [drill site] use.”³ The City of Los Angeles did not merely authorize siting this drill site in an existing residential neighborhood; indeed, the City of Los Angeles used its powers *to put* the Jefferson Drill Site within an existing residential neighborhood. The City of Los Angeles cannot now simply cast aside its critical role in monitoring the Jefferson Drill Site’s ongoing operations and in protecting impacted residents.

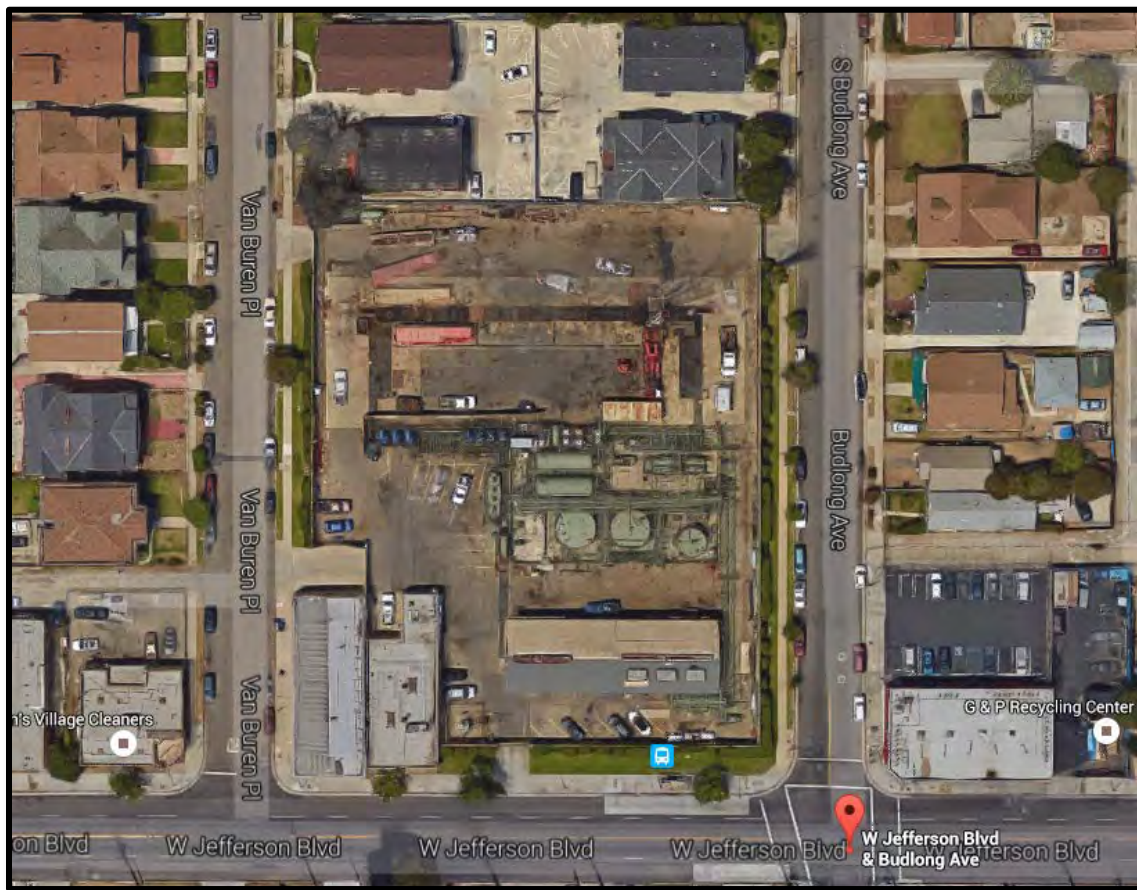


Figure 1 – Google Map Aerial View of Jefferson Drill Site.

² Letter from Huber E. Smutz, Chief Zoning Administrator, to Fred M. Anderson, Union Oil Company at 11 (Apr. 29, 1965).

³ *Id.*

During the past several years, the community has presented evidence to the Department showing that the Jefferson Drill Site is a nuisance. Despite this evidence, the community continues to be negatively impacted by this facility's uncontrolled noxious odors, as well as chemical fumes, obnoxious noises, and glaring lights, that adversely affect their peace, health and/or safety.

For the reasons outlined in this petition, Redeemer Community Partnership respectfully requests that the Department exercise its authority to institute a nuisance abatement proceeding and impose additional operating conditions and penalties, as detailed *infra* Section III, to abate the ongoing nuisances.

I. The Los Angeles Department of City Planning Has the Legal Authority to Abate Ongoing Nuisances that Adversely Affect the Public's Peace, Health and/or Safety.

The Department has two separate sources of authority to address the ongoing impacts caused by the Jefferson Drill Site and a clearly defined procedure under the LA Code to exercise that authority through a nuisance abatement proceeding.

First, the LA Code gives the Department broad authority and direction to ensure that the residents of the City of Los Angeles are protected from a land use that "adversely affects the health, peace or safety of persons residing in the surrounding area."⁴ Further, when interpreting the LA Code or undertaking proceedings under it, the Department is required to "promote justice" for the residents of the City of Los Angeles.⁵

Second, the Plan Approvals issued to the operator of the Jefferson Drill Site,⁶ under Case No. ZA 17528, provide additional authority to the Office of the Zoning Administrator to abate the Jefferson Drill Site's ongoing nuisance and interference with the peaceful enjoyment of the adjoining and neighboring properties in the community, including threats to the health and safety of nearby residents.

Based on the above authority, the City of Los Angeles has a clear and unambiguous right from separate and overlapping sources to address the ongoing nuisances caused by the Jefferson Drill Site. Given the impacts caused by the Jefferson Drill Site operations, as detailed

⁴ LOS ANGELES, CAL., MUN. CODE § 12.27.1(A) (2015) ("MUN. CODE"), [http://library.amlegal.com/nxt/gateway.dll/California/lamc/municipalcode?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:losangeles_ca_mc](http://library.amlegal.com/nxt/gateway.dll/California/lamc/municipalcode?f=templates$fn=default.htm$3.0$vid=amlegal:losangeles_ca_mc).

⁵ MUN. CODE § 11.00(c) ("The provisions of this Code and all proceedings under it are to be construed with a view to effect its objectives and to promote justice.").

⁶ The current operator of the Jefferson Drill Site is Freeport McMoRan Oil and Gas, LLC; however, there have been prior operators. Each subsequent operator is bound by the terms of all the prior approvals. See, e.g., Letter from Anik Charron, Associate Zoning Administrator, RE: Approval of Plans – Determination of Methods and Conditions for Case No. ZA 17528(PA3), at 4 (Apr. 22, 2008) ("This authorization runs with the land.").

by the evidence in this petition, it is undeniable that the Department must exercise its authority to abate the ongoing nuisances to remedy current harms and to prevent future harms.

i. Authority Provided by the Los Angeles Municipal Code

Oil production operations in the City of Los Angeles are subject to standard conditions under the LA Code, in addition to other conditions that the Zoning Administrator may apply to “afford greater protection to the surrounding property” and that are “deemed necessary and proper” by the Zoning Administrator.⁷ The authority to impose additional conditions is consistent with the Department’s obligation to “protect the public peace, health and safety . . . of persons residing or working in the surrounding area.”⁸

Through a nuisance abatement proceeding, the Zoning Administrator has the authority to enforce the standard conditions under the LA Code and those imposed by the Department. Under the LA Code, the violation of conditions issued by the Zoning Administrator “constitute[s] a violation of [the Los Angeles Municipal] Code.”⁹ Further, the LA Code explicitly states that “any violation of any provision of [the Los Angeles Municipal Code] is declared to be a public nuisance and may be abated by the City or by the City Attorney.”¹⁰ Accordingly, the Zoning Administrator has the authority to institute nuisance abatement proceedings to protect the public peace, health, and safety of the surrounding community.¹¹

ii. Authority Provided by the Plan Approvals

On April 29, 1965, the Chief Zoning Administrator authorized Union Oil Company to drill for and extract oil at the site we now call the Jefferson Drill Site, under Case No. ZA 17528. That authorization stated the following:

“[T]he Chief Zoning Administrator reserves the right to impose additional conditions or require corrective measures to be taken if he finds after actual observation or experience with drilling one or more of the wells on the subject property that additional conditions are necessary to afford greater protection to adjacent or surrounding property as intended by the provisions of section 13.01 of the Municipal Code, as well as the conditions set forth in Ordinance No. 123760.”¹²

⁷ MUN. CODE § 13.01(E)(2)(a)-(i) (oil operations in an urbanized area are subject to various standard conditions); MUN. CODE § 13.01(K)(1)-(5) (“existing and future oil wells within the City of Los Angeles” are required to meet the requirements under this subsection); MUN. CODE § 13.01(F).

⁸ MUN. CODE § 12.27.1.

⁹ MUN. CODE § 13.18.

¹⁰ MUN. CODE § 11.00(I).

¹¹ MUN. CODE § 12.27.1.

¹² Letter from Huber E. Smutz, *supra* note 2, at 9.

Subsequent to the April 1965 Plan Approval, the operators of the Jefferson Drill Site have sought, and received, additional approved plans from the Zoning Administrator. On April 22, 2008, the Department issued the most recent Plan Approval which continues to contain language authorizing the Department to act to protect the surrounding community:

“8. The authorized use shall be conducted at all times with due regard for the character of the surrounding district, and the right is reserved to the Zoning Administrator to impose additional corrective conditions, if, in the opinion of the Zoning Administrator, such conditions are proven necessary for the protection of persons in the neighborhood or occupants of adjacent property.

9. All lighting on the site shall be shielded and directed onto the site and no floodlights shall be located so as to be seen directly from any adjacent residential area.

10. At any time during the validity of this grant, should documented evidence be submitted showing continued violation of any condition of this grant, resulting in an unreasonable level of disruption or interference with the peaceful enjoyment of the adjoining and neighboring properties, the Zoning Administrator reserves the right to require the applicant to file for a plan approval application . . . the purpose of which will be to hold a public hearing to review the applicant’s compliance with and the effectiveness of these conditions.”¹³

Accordingly, the Department has the authority to provide relief to the surrounding neighbors of the Jefferson Drill Site. The Department’s authority is clear and unambiguous even if other city, state, or federal agencies have separate obligations to oversee the Jefferson Drill Site.

II. The Jefferson Drill Site Adversely Affects the Health, Peace, and/or Safety of Residents, Disrupting the Peaceful Enjoyment of Surrounding Properties and Thereby Operating in Violation of Applicable Law.

The Jefferson Drill Site is located on a 1.86 acre site in the very densely populated South Los Angeles area. Indeed, according to the Los Angeles Times, the Adams-Normandie area where the Jefferson Drill Site is located is the 10th most densely populated among the 272 neighborhoods in Los Angeles County.¹⁴ Because of the population density in the area, the Jefferson Drill Site has active wells extremely close to homes adjacent to the site. In fact, the homes nearest to the property line of the Jefferson Drill Site are less than three feet away, and the well cellar is less than 60 feet away.

¹³ Letter from Anik Charron, *supra* note 6.

¹⁴ *Population Density*, L.A. TIMES, <http://maps.latimes.com/neighborhoods/population/density/neighborhood/list/> (last visited Jan. 22, 2016).

The meager buffer that once provided minimal separation between the residents and the operations at this facility no longer exists as a result of the Department's decision-making. In 1965, when the Jefferson Drill Site was approved, the Department required Union Oil to own and maintain the four lots immediately adjacent to the site as "a buffer between the proposed activities and the residential development to the north of the same block."¹⁵ Despite establishing this requirement, in 1999, the Department authorized the sale of those vacant "buffer properties" for use as housing for students attending the University of Southern California.¹⁶ The Department's decision to approve this site and to then eliminate the buffer properties resulted in residents living directly adjacent to the Jefferson Drill Site, exposing these neighbors to noxious odors and fumes, noise and other disturbances emanating from the Jefferson Drill Site.

However, the negative impacts of the Jefferson Drill Site are not solely experienced by the residents living directly adjacent to this facility. As was made clear by the November 25, 2014 hearing held by the Office of Zoning Administrator concerning this site, the adverse effects are also felt by the community at-large. At this hearing, hundreds of residents attended to voice their concerns related to the Jefferson Drill Site.¹⁷ For several hours, community members testified at this hearing about the various ways that the Jefferson Drill Site's operations have unreasonably disrupted or interfered with their lives and peaceful enjoyment of their homes and workplaces.¹⁸ Despite the community's testimony, the nuisance activities detailed during this hearing continue to be unaddressed.

As of the date of this petition, residents living near the Jefferson Drill Site continue to be burdened by the operations at this site. For example, on March 10, 2016, Niki Wong, lead community organizer with Redeemer Community Partnership, observed trucks coming and going from the site carrying long pipes and other materials throughout the day. While at the Jefferson Drill Site, workers revved a diesel motor to pull the pipes off the trucks, and as the pipes were pulled into place, loud clanging noises were made as the 50 foot long pipes hit one another. Ms. Wong noted that the neighborhood was filled with significant amounts of noise,

¹⁵ Letter from Huber E. Smutz, *supra* note 2, at 11.

¹⁶ Letter from Leonard S. Levine, Associate Zoning Administrator, RE: Approval of Plans – Determination of Methods and Conditions for Case No. ZA 17528(PAD), at 5 (Dec. 3, 1999).

¹⁷ Office of Zoning Administration, Notice of Public Hearing (Nov. 25, 2014). We incorporate by reference all of the community testimony given during that hearing, in support of this Petition.

¹⁸ Emily Alpert Reyes, *Neighbors Push Back Against Drilling Plan at South L.A. Site*, L.A. TIMES (Nov. 25, 2014), <http://www.latimes.com/local/lanow/la-me-ln-neighbors-oil-drilling-20141125-story.html>; Molly Peterson, *Decision Delayed on Expanded Oil Drilling in West Adams*, SOUTHERN CALIFORNIA PUBLIC RADIO (Nov. 26, 2014), <http://www.scpr.org/news/2014/11/26/48303/decision-delayed-on-expanded-oil-drilling-in-west/>; John Schreiber, *Zoning Officer Puts Off Decision on Urban Oil Field in South Los Angeles*, MY NEWS LA (Nov. 25, 2014), <http://mynews1a.com/government/2014/11/25/zoning-officer-puts-decision-urban-oil-field-south-los-angeles/>

fumes, and diesel exhaust the entire day. Additionally, that same day, residents witnessed the spraying of large containers filled with “CHEMCO Jasmine Odor Control” at the site, as reflected in Figures 2 and 3 below. The CHEMCO website states that their odor control chemicals specialize in masking odors associated with Hydrogen Sulfide or H_2S .¹⁹ As discussed in detail below, H_2S is a particularly dangerous chemical that naturally occurs in oil and is also found in chemicals brought onto this site. The Jasmine Odor Control was sprayed all day on March 10, 11, and 14, just a few feet from the surrounding homes and sidewalk outside the site walls. According to the Jasmine Odor Control Material Safety Data Sheet,²⁰ Jasmine Odor Control contains a chemical called nonylphenol ethoxylate, a compound suspected of disrupting the endocrine system and hormones. Disruption of the endocrine system causes significant harm to the reproductive system, including infertility, cancer, and malformations in children before and after birth.²¹ There is also “mounting evidence for effects of these chemicals on thyroid function, brain function, obesity and metabolism, and insulin and glucose hemostasis.”



Figure 2 – Photograph of Equipment and Spraying of Jasmine Odor Control on March 10, 2016.

¹⁹ Chemco Products Company, http://www.chemcoprod.com/oil_products.htm (accessed March 24, 2016).

²⁰ Flo-kem, Odor Control Jasmine Safety Data Sheet.

²¹ WORLD HEALTH ORGANIZATION, STATE OF THE SCIENCE OF ENDOCRINE DISRUPTING CHEMICALS 2012: SUMMARY FOR DECISION-MAKERS (2012).



Figure 3 – Close-up Photograph of Jasmine Odor Control Container on March 10, 2016.

Contrary to the LA Code and the Plan Approval, activities such as these are not undertaken with “due regard for the character of the surrounding district.” Rather, the odor and noise, as well as use of chemicals and industrial lighting, at the Jefferson Drill Site are out of step with the residential community surrounding this facility. Oil production activities make the comfortable enjoyment of property near the site impossible and threaten residents’ health and safety.

Given this reality, it is imperative that the Department consider both the history of past violations; the certainty that routine operations will continue to cause noise, odors, fumes, and excessive lighting; and the risk of a future catastrophic accident when (1) evaluating the ongoing nuisance conditions caused by the Jefferson Drill Site; and (2) considering the proper conditions that the Department ought to place upon this site to ensure that residents are protected from the negative effects of this site’s ongoing operations. With this in mind, the following highlights some of the issues that were raised in November 2014 and that remain unaddressed at the Jefferson Drill Site:

i. Obnoxious Odors and Fumes

a. Fumes from crude oil operations

The LA Code establishes that “oil wells shall be sealed so that no offensive or obnoxious odor or fumes can be readily detected from any point on adjacent property.”²² According to

²² MUN. CODE § 13.01(K)(2).

the South Coast Air Quality Management District (“SCAQMD”),²³ “foul odors can be extremely objectionable, cause symptoms such as headaches and nausea and significantly impact residents’ quality of life, especially if they are present on an ongoing basis.”²⁴

Fumes from chemicals that occur naturally in crude oil—as well as chemicals trucked onto the Jefferson Drill Site and from diesel exhaust—have confirmed negative health impacts that range from causing short-term respiratory problems to causing cancer and reproductive damage.²⁵ While these harms impact everyone, they more severely affect vulnerable residents, particularly children and the elderly.

Residents have testified that they regularly smell disturbing odors and fumes from the Jefferson Drill Site. For example, in advance of the November 25, 2014 hearing, Matthias Lenz informed the Zoning Administrator that “unpleasant odors on a regular basis”²⁶ come from the Jefferson Drill Site. These fumes smell of petroleum and diesel and linger in the air. Residents also report that they are forced to stay indoors and to keep their windows closed to try to reduce their exposure to these odors and fumes—unfortunately, residents have had no success with this approach.²⁷ Indeed, as the Department learned at the November hearing, the petroleum odor and diesel fumes from this site can be so severe that it has forced some families to leave the area due to health concerns.²⁸

Residents have been complaining for years to the Department and other agencies about the odors emanating from the site. For example, in October 2013 the SCAQMD responded to an odor complaint during which the inspector noted that he “conducted odor surveillance and detected mild petroleum odors” on the corner outside of the facility.²⁹ A second example of this problem occurred on July 15, 2014. On that date, residents logged nine complaints with the SCAQMD describing a “strong odor” smelling like “petroleum,” “fumes,” and “oil.”³⁰ SCAQMD responded to the complaints and found that equipment at the site was releasing air contaminants that could be smelled outside of the facility; that diesel exhaust stacks extended beyond the height of the walls; that there were measureable readings of Hydrogen Sulfide; and that a wastewater skimmer had a leak that violated SCAQMD rules by releasing the known

²³ The SCAQMD is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties.

²⁴ Louis Sahagun, *Chemical Odor, Kids’ Nosebleeds, Few Answers in South L.A. Neighborhood*, L.A. TIMES (Sept. 21, 2013), <http://articles.latimes.com/2013/sep/21/local/la-me-0922-oil-20130922>.

²⁵ OFFICE OF ENVTL. HEALTH HAZARD ASSESSMENT AND AM. LUNG ASS’N OF CALIFORNIA, HEALTH EFFECTS OF DIESEL EXHAUST FACT SHEET.

²⁶ Email from Matthias Lenz to Jojo Pewsawang (Nov. 21, 2014).

²⁷ See, e.g., testimony of Myrna Gallardo, *supra* note 1.

²⁸ Testimony of Richard Parks (Nov. 25, 2014).

²⁹ SCAQMD Complaint Report, Complaint 238195 (Oct. 18, 2013).

³⁰ SCAQMD Complaint Report, Complaint 244264 (July 15, 2014).

carcinogens benzene, toluene, ethylbenzene, and xylene.³¹ The SCAQMD inspector also noted that the operator was “doing an acidizing job” on one of the wells describing the work as “routine maintenance/cleanout.”³² The SCAQMD issued a Notice of Violation to the operator of the Jefferson Drill Site as a result of this visit. As the community complaints show, and the SCAQMD inspector confirmed, odors and fumes are clearly detectable in the neighborhood surrounding the Jefferson Drill Site. Further, this violation of the LA Code and the facility’s Plan Approval did not occur during an extraordinary or unusual event, rather these violations happened during routine, regularly occurring operations that will continue to take place at the Jefferson Drill Site in the future.

The odors from the site can occur both from chemicals that are a natural part of crude oil as well as from chemicals that are brought to the site. For example, Hydrogen Sulfide, or H₂S, is a natural part of crude oil that “is a poisonous, flammable, colorless gas that smells like rotten eggs.” The California Division of Oil, Gas and Geothermal Resources (“DOGGR”)³³ notes in a Permit to Conduct Well Operations issued in May 2014 for work at the Jefferson Drill Site that because H₂S “is known to be present in this area, adequate safety precautions shall be taken prior to and during well operation.”³⁴ The “Notice of Intention to Rework/Redrill Well” submitted to DOGGR includes a warning in its well work plans stating: “WARNING: Beware of potential of hydrogen sulfide gas (H₂S) and its inherent dangers while performing well work and take the appropriate safeguards for dealing with H₂S gas.” Neither the permit issued by DOGGR nor the Notice of Intention submitted by the operator identifies what those precautions or safeguards are at the Jefferson Drill Site. Further, the DOGGR files do not indicate that there has been any evaluation of whether those precautions or safeguards are adequate nor confirmation that those precautions or safeguards are actually in place.

People can usually smell Hydrogen Sulfide at very low concentrations in the air³⁵ and inhale or absorb it through the skin. Even at low levels, it can irritate the eyes, nose and throat and cause breathing difficulties for people with asthma.³⁶ In fact, H₂S is extremely dangerous as reports from other oil producing parts of the country detail. One extreme example was documented in a 2014 news article that discusses the increase in incidents of H₂S exposures and related harms caused by the oil drilling boom underway throughout the United States. That article also describes an incident in Texas in 1975, when an oil well sprang a leak, releasing H₂S. As a result, 9 people died when they were overcome with H₂S, including 8 people gathered

³¹ SCAQMD Report of Laboratory Analysis (July 16, 2014).

³² *Id.*

³³ DOGGR is a state agency within the Department of Conservation responsible for overseeing the drilling, operation, maintenance, and plugging and abandonment of oil wells in California.

³⁴ DOGGR, Permit to Conduct Well Operation 2 (May 29, 2014); Notice of Intention to Rework/Redrill Well 3 (May 29, 2014).

³⁵ AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, TABLE OF CHEMICAL CONSTITUENTS COMMONLY FOUND IN CRUDE OIL.

³⁶ *Id.*

at a home only 150 to 200 yards from the oil well.³⁷ This case highlights the significant harm and death that H₂S can cause.

In addition to H₂S, there are several other chemicals that are commonly found in crude oil and also used in oil well “routine maintenance” that have odors that are sweet-smelling, smell like gasoline, or smell like mothballs that have confirmed carcinogenic or other known health impacts from exposure to them, including benzene, ethyl benzene, toluene, xylene, naphthalene, and various alkanes.³⁸ The SCAQMD’s records confirm that air sampling for these carcinogens conducted on July 15, 2014 and September 13, 2014 identified the presence of these chemicals from equipment emissions in the wastewater area of the Jefferson Drill Site. These smaller, routine releases create health risks for surrounding residents that will not be evident for years or decades. Despite the long timeframe over which these harms manifest, the harms are real and cannot be ignored.

It is not unexpected that residents near the Jefferson Drill Site would report encountering odors and fumes given that oil operations often result in odor complaints at other sites in Los Angeles and around the country. For example, when the SCAQMD monitored a well stimulation “matrix acidizing” treatment in Orange County, it found that “petroleum hydrocarbon odors” could be smelled “75 feet from subject well.”³⁹ The same odor-causing activities also occur at the Jefferson Drill Site, where residents are less than 75 feet from the subject wells.

Another example involves the AllenCo Site, which is located about a mile from the Jefferson Drill Site and sits atop the same oil reserve (*i.e.* the Las Cienegas Oil Field). Residents and workers near the AllenCo Site logged approximately 215 odor complaints between 2008 and 2013 with the SCAQMD. In response, the SCAQMD issued at least 15 citations to the facility. Indeed, the SCAQMD’s deputy field officer for engineering and compliance noted that the problems at the AllenCo Site “boil[] down to incompatible zoning decisions.”⁴⁰

The AllenCo Site is very similar to the Jefferson Drill Site not only in size, but also in terms of equipment used, the well count, and the oil produced. Furthermore, the AllenCo Site is analogous to the Jefferson Drill Site in that (1) people live and work adjacent to both of these facilities; and (2) incompatible zoning decisions have resulted in people living adjacent to these oil production sites. Experiences both at the Jefferson Drill Site as well as at other drill sites that engage in oil production activities confirm that odors and fumes from regular operations

³⁷ Mike Lee, “*That Stuff Can Get You So Fast*”—*Deadly Gas on The Rise in Oil Fields*, E&E REPORTER (Oct. 21, 2014), <http://www.eenews.net/stories/1060007591>.

³⁸ TABLE OF CHEMICAL CONSTITUENTS COMMONLY FOUND IN CRUDE OIL, *supra* note 35.

³⁹ SCAQMD, Update on Implementation of Rule 1148.2, at 42 (Nov. 12, 2014); Rule 1148.2 (d) notification for Event ID 2238.

⁴⁰ Sahagun, *supra* note 24.

impact nearby residents. These are the exact conditions that are unlawful under the LA Code and the Plan Approval for the Jefferson Drill Site.

b. Fumes from chemicals trucked into the neighborhood

Residents near the Jefferson Drill Site are also exposed to toxic fumes from chemicals trucked onto the site. Beginning in June 2013, the SCAQMD required oil well operators to disclose, via an electronic “event notification,” when and where they use any of three select methods of enhancing oil recovery known as acidizing, gravel packing and hydraulic fracturing. Under these regulations, operators are also required to disclose the type and quantity of chemicals used in those operations. Based upon the information made available to the SCAQMD by the operators of the Jefferson Drill Site, it is apparent that thousands of gallons of chemicals that are known air toxics are regularly trucked into this neighborhood for use at the Jefferson Drill Site.

Between July 2013 and July 2014, the SCAQMD tracked six “events” covered by the reporting rule at the Jefferson Drill Site.⁴¹ In total, these events resulted in the delivery and use of 25 tons of liquid chemicals at the Jefferson Drill Site. Included in these numbers are almost 4 tons of hydrochloric and hydrofluoric acid, nearly a ton of known endocrine disruptors, and one-and-a-half tons of known air toxics.⁴² In addition to these six events, a seventh event occurred in November 2015. As a result of a change to the SCAQMD’s Rules that occurred in September 2015, the information about the chemicals used during that seventh “event” are less clear. The Jefferson Drill Site operator claimed that eleven tons of the “mass” of material transported to and used at the site in November 2015 were protected trade secrets and therefore the names of chemicals used at the site were not subject to disclosure.

Records maintained by SCAQMD are incomplete and under-report the number of trucks transporting chemicals onto the Jefferson Drill Site. The SCAQMD only requires event reporting by operators when an *oil extraction* well is being acidized to stimulate oil production. As a result, the Jefferson Drill Site operator is not required to report *injection well* acidizing activities, such as the one in Figure 4 photographed on October 3, 2014. The SCAQMD’s record of chemicals trucked into and used at the Jefferson Drill Site obscures the magnitude of the regular and ongoing operations—and the associated noise, chemicals, odors, and fumes—to which the community is subjected.

⁴¹ The general term “events” is used to describe various occurrences of the activities tracked by the SCAQMD because that is how the SCAQMD refers to these activities.

⁴² According to SCAQMD records, chemicals used at this site that are of particular concern include Methanol and 2-Butoxyethanol.



Figure 4 – Photograph of Chemical Trucks Idling at the Jefferson Drill Site on October 3, 2014.

There is no reliable system in place that allows the Department, or the residents, to know either the extent or the magnitude of emissions from the Jefferson Drill Site. Nor is there a reliable system in place that allows the Department, or the residents, to know whether or how exposure to emissions from this site impacts the health of residents. What is known, given the nature of the chemicals trucked to and used at this site, is that a tragedy of monumental proportions is very possible. An accident while transporting chemicals to and from the site or during the on-site storing or pumping of these chemicals into the wells, could be catastrophic. Even a short-lived leak could have a significant impact on the surrounding community given the highly toxic nature of the chemicals being used.

c. Fumes from diesel exhaust

In addition to the odors that are expected to occur naturally from the crude oil itself, community members report smelling exhaust from diesel equipment and trucks that routinely run at the site. Residents report that diesel trucks regularly come and go from the Jefferson Drill Site and as these trucks idle on site, often between six to nine hours, the diesel exhaust from the trucks enters residents' homes. Residents are not able to keep these fumes out of their homes and cannot escape the fumes that move around the neighborhood.

In 1998, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment ("OEHHA") reviewed all the existing data regarding the health hazards caused by exposure to diesel exhaust. Based upon OEHHA's findings, the California Air Resources Board determined that diesel exhaust is a toxic air contaminant. The OEHHA assessment found that:

"Exposure to diesel exhaust can have immediate health effects. Diesel exhaust can irritate the eyes, nose, throat and lungs, and it can cause coughs, headaches, lightheadedness and nausea. In studies with human volunteers, diesel exhaust particles made people with allergies more susceptible to the materials to which they are allergic, such as dust and pollen. Exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks."⁴³

In addition to these immediate health effects, exposure to diesel exhaust has long-term health effects. OEHHA explains:

"As we breathe, the toxic gases and small particles of diesel exhaust are drawn into the lungs. The microscopic particles in diesel exhaust are less than one-fifth the thickness of a human hair and are small enough to penetrate deep into the lungs, where they contribute to a range of health problems.

Diesel exhaust and many individual substances contained in it (including arsenic, benzene, formaldehyde and nickel) have the potential to contribute to mutations in cells that can lead to cancer. In fact, long-term exposure to diesel exhaust particles poses the highest cancer risk of any toxic air contaminant evaluated by OEHHA."

The neighbors and community surrounding the Jefferson Drill Site are exposed to diesel exhaust from truck traffic, idling trucks, and diesel powered equipment routinely used at the site. This reality is troubling, as OEHHA notes:

"Diesel engines are a major source of fine-particle pollution. The elderly and people with emphysema, asthma, and chronic heart and lung disease are especially sensitive to fine-particle pollution. Numerous studies have linked elevated particle levels in the air to increased hospital admissions, emergency room visits, asthma attacks and premature deaths among those suffering from respiratory problems. Because children's lungs and respiratory systems are still developing, they are also more susceptible than healthy adults to fine particles. Exposure to fine particles is associated with increased frequency of childhood illnesses and can also reduce lung function in children."

⁴³ OFFICE OF ENVTL. HEALTH HAZARD ASSESSMENT AND AM. LUNG ASS'N OF CALIFORNIA, *supra* note 25.

The health impacts associated with ongoing exposure to diesel exhaust from both the trucks visiting the Jefferson Drill Site, as well as the various operations that occur at this site, are deeply problematic. Further, it is likely that wells will be drilled or re-drilled at the Jefferson Drill Site.⁴⁴ According to the SCAQMD, drilling or re-drilling of wells carries significant cancer risk to the surrounding neighborhood. The SCAQMD found that the “average” drilling job of the type undertaken at the Jefferson Drill Site would last 102 hours over 19 days and use 11 diesel engines⁴⁵ with an estimated cancer risk for a single drilling event of between 1.65 and 7.12 in a million for residents 100 feet away. Here, because the Department removed the “buffer” between the Jefferson Drill Site and adjacent homes, the cancer risk is even higher given that residents are less than 60 feet away from the drilling site.⁴⁶

The odors and fumes from operations that residents around this site are exposed to provide ample evidence of violations of the LA Code, which states that “oil wells shall be sealed so that no offensive or obnoxious odor or fumes can be readily detected from any point on adjacent property.”⁴⁷ Exposure to noxious odors from the ongoing operations at the Jefferson Drill Site interferes with residents’ peaceful enjoyment of their property. These odors also provide evidence of a significant health threat from the Jefferson Drill Site to the residents of the surrounding properties. As Dr. James Dahlgren, a toxicology expert stated in reference to the AllenCo Site: “If you can smell it, it’s not safe.”⁴⁸ That principle is relevant here as well. In the time since this drill site was placed in this neighborhood, science has provided indisputable proof that exposure to diesel exhaust and other chemicals that occur naturally in crude oil or are trucked in for use at this site are extremely hazardous to human health. The Department is not free to ignore that science. The Department must take steps to protect the health and safety of people who live in the neighborhood surrounding the Jefferson Drill Site.

ii. Annoyance Caused by Vibration and Noise

Both the LA Code and the Department’s Plan Approval by incorporation, prohibit any production operations or “anything incident thereto” from causing “vibration . . . or annoying substances or effect” on “persons living in the vicinity.”⁴⁹ Nonetheless, residents report experiencing noise and vibration caused by activities at the Jefferson Drill Site that continue to be unaddressed.

⁴⁴ See, e.g., Application for Determination of Methods and Conditions for Drilling Jefferson Controlled Drill Site (July 5, 2013).

⁴⁵ SCAQMD, *supra* note 39, at 21.

⁴⁶ *Id.* at 25.

⁴⁷ MUN. CODE § 13.01(K)(2).

⁴⁸ Sahagun, *supra* note 24.

⁴⁹ MUN. CODE § Code 13.01(F)(18).

For example, Hamilton Yang, a resident who lives on Van Buren Place across the street from the Jefferson Drill Site says that while sitting at his dining room table on March 10, 2016, he witnessed ripples in his glass of water that was on the table. He then felt steady vibrations in his house. Initially, he thought it was an earthquake, but after the vibrations did not stop, he realized that the shaking was being caused by work at the Jefferson Drill Site. His upstairs neighbor, Corissa Pacillas-Smith, also notes that these vibrations are a common experience for her when there is activity at the drill site.

In addition, there are multiple reports from residents that noise from the Jefferson Drill Site is routine, with punctuated periods of extremely loud noises. For example, in a November 23, 2014 e-mail to the Zoning Administrator, a resident reported that:

"I (Jennifer) visited a neighbor who lives on Van Buren Place in the apartment directly north of the site and tried to have a conversation with him on his front porch. The noise from the site activity made it difficult for us to hear each other speaking."⁵⁰

Activities that the operator of the Jefferson Drill Site characterizes as "routine" involves pipes being driven into the ground by powerful, heavy-duty diesel engines. These operations are problematic because of the noise and vibration that continue for days at a time and can be heard throughout the neighborhood. Residents like Myrna Gallardo and Jackie Garcia reported that the noise is so loud, it frightens their children.⁵¹

In addition to these punctuated periods of noise, the regular day-to-day operations at the site cause what has been described as "buzzing" throughout the night that disturbs the peace of the residents, making it difficult to sleep. It is well known that too much noise not only disturbs the peaceful enjoyment of one's home, but it also harms both physical and mental health. Recent studies have increasingly focused on "non-auditory" effects of noise on health. These studies have found health effects beyond simply a loss of hearing, specifically annoyance, sleep disturbance, daytime sleepiness, hypertension, cardiovascular disease, and diminished cognitive performance in school children.⁵² Other studies have also confirmed that excessive noise exposure may negatively impact newborns and fetuses, leading to developmental delays, brain chemistry changes, and loss of high-frequency hearing.⁵³ These non-auditory health effects are considered to have a significant impact on people at both high-noise levels, such as those associated with the drilling and other "routine" activities at the Jefferson Drill Site, as well as at levels associated with the "buzzing" noise at night. The World Health Organizations has

⁵⁰ E-mail from Jennifer Redekopp to Jojo Pewsawang (Nov. 23, 2014).

⁵¹ "Routine" Planning Hearing Raises Questions About L.A.'s Oversight on Oil Drilling, SOUTHERN CALIFORNIA PUBLIC RADIO (Nov. 24, 2014), <http://www.scpr.org/news/2014/11/24/48254/routine-planning-hearing-raises-questions-about-l/>.

⁵² Mathias Basner et al., *Auditory and Non-Auditory Effects of Noise on Health*, 383 *Lancet* 1325 (2014).

⁵³ Ron Chepesiuk, *Decibel Hell: The Effects of Living in a Noisy World*, ENVIRON. HEALTH PERSPECT. A43 (2005).

defined night noise levels as low as 30 decibels (“dB(A)”) ⁵⁴ as having an effect on health, particularly among children, the chronically ill, and the elderly. Noise levels above 55 dB(A), according to the World Health Organization, are “considered increasingly dangerous for public health There is evidence that the risk of cardiovascular disease increases.” ⁵⁵

A study conducted in La Plata County, Colorado, as well as a Draft Environmental Impact Statement (“EIS”) developed by the Bureau of Land Management (“BLM”), reviewed noise levels for certain oil and gas field activities and confirmed the following noise levels for equipment commonly used: ⁵⁶

Source	La Plata County, CO Study	BLM Draft EIS ⁵
Compressor	50 dBA (375 feet from property boundary)	89 dBA (50 feet from source) ⁶
Pumping units	50 dBA (325 feet from well pad)	82 dBA (50 feet from source)
Fuel and water trucks	68 dBA (500 feet from source)	
Crane for hoisting rigs	68 dBA (500 feet from source)	
Pump used during drilling	62 dBA (500 feet from source)	
Average well construction site	65 dBA (500 feet from source)	83 dBA (50 feet from source)
Produced water injection		71 dBA (50 feet from source)

⁵ Bureau of Land Management, *Draft RMPA/EIS for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties* (Oct. 2000)

Importantly, the levels from La Plata County are measured at between 325 and 500 feet from the property boundary; even at those distances, however, the noise is considerable. The Jefferson Drill Site’s well cellar is approximately 60 feet from the nearest home. This means the BLM Draft EIS levels are more akin to what would be experienced by residents near the Jefferson Drill Site. Noise levels from 71 dB(A) to 89 dB(A) are above regular conversation levels and busy roadways. For example, a California Department of Transportation (“CalTrans”) “Loudness Comparison Chart” indicates that “normal speech at 3 [feet]” occurs at about 70 dB(A) and a “Noisy Urban Area, Daytime” is about 75 dB(A). ⁵⁷ At nighttime, CalTrans notes that

⁵⁴ According to Chepesiuk, *supra* note 53: “[T]he unit A-weighted dB (dBA) is used to indicate how humans hear a given sound. Zero dBA is considered the point at which a person begins to hear sound. A soft whisper at 3 feet equals 30 dBA, a busy freeway at 50 feet is around 80 dBA, and a chain saw can reach 110 dBA or more at operating distance. Brief exposure to sound levels exceeding 120 dBA without hearing protection may even cause physical pain.”

⁵⁵ Basner, *supra* note 52, at 9.

⁵⁶ R. Timothy Weston & Tad Macfarlan, *Noise Regulation of the Shale Oil & Gas Extraction and Production Industry*, 6th Law of Shale Plays Conference, INSTITUTE FOR ENERGY LAW 4 (2015).

⁵⁷ *Loudness Comparison Chart (dBA)*, CALTRANS, <http://www.dot.ca.gov/dist2/projects/sixer/loud.pdf> (last visited May 16, 2016).

the noise level in an urban area is about 45 dB(A).⁵⁸ Given these facts, it is unsurprising that Kara Clemens, a resident who lives “directly next to the [Jefferson Drill Site]”, wrote to the Department in 2013 stating that “the company is constantly a nuisance on the street and is extremely loud in the mornings.”⁵⁹

While it appears that the Jefferson Drill Site operator paid for a noise report in 2006, the report accepted as “ambient” the regular and on-going noise caused by the facility’s operations and did not report the actual noise levels from drilling or maintenance operations at the site.⁶⁰ Further, the report provided information only about the peak noise levels expected from drilling with a 30 foot high sound wall—notably, residents report that the Jefferson Drill Site utilizes the required 30 foot sound wall only when actually drilling a well, but never during the routine use of the workover rig employed for its maintenance operations. For example, on October 14, 2015, a workover rig operated at the Jefferson Drill Site with no sound insulation as shown in the Figure 5 photograph. As a result, the Department does not have any location specific data about either the regular and on-going noise caused by the facility’s operation nor about the noise caused by workover rigs used at the site despite their regular presence in the neighborhood. Neighbors have recorded the presence of a workover rig, with no sound insulation, on at least five days during the period of January to May 2016 alone.



Figure 5 – Photograph of Workover Rig at Jefferson Drill Site on October 14, 2015.

⁵⁸ *Id.*

⁵⁹ Email from Kara Clemens to Daniel Skolnick (Sept. 21, 2013).

⁶⁰ *See, generally*, Letter from Don Behrens, Behrens and Associates, Inc., to Edgar Salazar, RE: Ambient Noise Survey, Drilling Impact Evaluation and Mitigation Report (Feb. 15, 2006).

The information that is available, however, confirms that oil production operations in general—as well as those at the Jefferson Drill Site—are extremely noisy, making them incompatible with “the character of the surrounding district” as required under the LA Code. As detailed, the regular operations at the Jefferson Drill Site disrupt the quiet enjoyment of residents, which is in violation of the LA Code and the Department’s approvals. Further, beyond simply creating a nuisance, excessive noise from this site is also a health threat that must be addressed.

iii. Disturbance from Nighttime Lighting

The Plan Approval issued by the Department requires that “all lighting on the site shall be shielded and directed onto the site and no floodlighting shall be located so as to be seen directly from any adjacent residential area.”⁶¹ Despite this clear requirement, residents adjacent to the oil field are subjected to disturbingly bright lights. Alina Evans, who was resident on Van Buren Place, described the site as being “lit up like mission control.”⁶² The photograph in Figure 6 captures this ongoing nuisance lighting that floods the neighborhood and adjacent buildings at night.



**Figure 6 - Photograph of Jefferson Drill Site Lighting on Adjacent Building
taken at Approximately 9pm on March 1, 2016.**

⁶¹ Letter from Leonard S. Levine, *supra* note 16, at 4.

⁶² “Routine” Planning Hearing, *supra* note 51.

Protecting the community from the nuisance caused by this site's intensive, industrial lighting is important because the health impacts of artificial outdoor lighting are real and significant. Not only can this light impact the ability of residents to sleep—which itself causes a range of health problems—artificial light at night can have other negative effects on human health. For example, research suggests a connection between artificial light and increased risk of cancer.⁶³ Studies have found that outdoor lighting may harm human health either directly, through light that reaches people indoors, or indirectly because people disturbed by the external light are woken up and turn on indoor artificial light. This light then has an impact on the production of hormones in ways that may have very serious health consequences.⁶⁴

Given the generally disruptive effects of bright nighttime lights, as well as the possible broader health consequences of nighttime light, it is clear that the Department should exercise its authority to ensure that the residents near the Jefferson Drill Site are being adequately protected from the site's use of nighttime lighting.

III. The Los Angeles Department of City Planning Has the Authority to Adopt Legal Remedies to Abate the Ongoing Nuisance Caused by the Jefferson Drill Site and to Prevent Future Harms.

As Lillian Marengo, a resident less than a block from the facility told the Department: "What we need is someone bigger than us with resources and power in order to change this company because they do not have respect for our community."

Because the Jefferson Drill Site is operating in violation of the LA Code and Plan Approval conditions resulting in it being a nuisance to the surrounding community, the Department must impose additional operating conditions and penalties to abate the nuisance and to prevent future impacts on the community's health, safety, and peace. Therefore, Redeemer Community Partnership asks, in accordance with the Plan Approval for this site, that the Department require Freeport-McMoRan ("FMOG") to "prepare a radius map and cause a notification to be mailed to all owners and occupants of properties within a 500-foot radius of the property, the Council Office, and the Los Angeles Police Department corresponding Division"⁶⁵ to inform the public that the Zoning Administrator will "hold a public hearing to review [FMOG's] compliance with and the effectiveness of" the conditions of its Plan Approval.⁶⁶ Further, in accordance with the LA Code, the Zoning Administrator should require

⁶³ Ron Chepesiuk, *Missing the Dark: Health Effects of Light Pollution*, ENVTL. HEALTH PERSPECTIVES A20 (Jan. 2009).

⁶⁴ *Id.*

⁶⁵ Letter from Leonard S. Levine, *supra* note 16, at 4.

⁶⁶ *Id.*

FMOG to “submit a summary and any supporting documentation of how compliance with each condition of this grant has been attained.”⁶⁷

After a public hearing on this matter, Redeemer Community Partnership requests that the Zoning Administrator require the Jefferson Drill Site to be completely enclosed within a building. The authority to require such an enclosure is explicitly granted by LA Code, section 13.01(F)(52), which states:

“That no oil, gas or other hydrocarbon substances may be produced from any well hereby permitted unless all equipment necessarily incident to such production is completely enclosed within a building, the plans for said building to be approved by the Department of Building and Safety and the Fire Department. This building shall be of a permanent type, of attractive design and constructed in a manner that will eliminate as far as practicable, dust, noise, noxious odors and vibrations or other conditions which are offensive to the senses, and shall be equipped with such devices as are necessary to eliminate the objectionable features mentioned above. The architectural treatment of the exterior of such building shall also be subject to the approval of the Administrator.”

It is important to note that other oil production sites operating in residential areas within the City of Los Angeles have been enclosed to reduce the impacts on the surrounding community. In particular, in 1965, the Zoning Administrator required the Doheny Site in West Los Angeles to be fully enclosed within a sound proof structure in order “to integrate the development into the well developed residential section to the north.”⁶⁸ The Doheny Site’s well cellar is 190 feet from its nearest neighbor; in contrast, the Jefferson Drill Site well cellar is only 60 feet from its nearest neighbor, with homes about 3 feet away from the site property line. The enclosure at the Doheny Site was removed in the mid-1980s but replaced in the late 1990s, along with 25 foot walls to enclose the site. The drilling derrick was fully enclosed and converted to electric, rather than diesel. All the operations, including truck deliveries, were moved indoors. Similarly, the Zoning Administrator also required the Packard Site, in Mid-City, to be enclosed when initially sited in 1966 because the facility was in a residential neighborhood.⁶⁹

Mr. Bertoni, similarly situated communities ought to be treated similarly. Redeemer Community Partnership seeks nothing more, or less, than to have their community protected from the health threats and nuisance conditions caused by the Jefferson Drill Site. The people of this community deserve, and are entitled to, the basic protections set out clearly and unambiguously in both the LA Code and in the Plan Approvals that have been granted by the

⁶⁷ *Id.*

⁶⁸ COMMUNITY HEALTH COUNCILS, OIL DRILLING IN LOS ANGELES: A STORY OF UNEQUAL PROTECTIONS 12 (2015).

⁶⁹ *Id.*

Department. The low-income community-of-color in South Los Angeles where the Jefferson Drill Site is located is entitled, both as a matter of law and as a matter of equity, to receive the same protections that have been afforded to the whiter, wealthier residents near the Doheny Site and Packard Drill Site. Accordingly, Redeemer Community Partnership requests that you use your unquestionable authority to ensure that communities near the Jefferson Drill Site receive the protections needed and required to address the ongoing impacts caused by this nuisance-producing facility.

Please contact our office at (415) 217-2000 or via email at ameszaros@earthjustice.org to discuss this petition. Thank you for your time and attention to this matter. We look forward to your prompt response to the concerns detailed in this petition.

Respectfully submitted,



Angela Johnson Meszaros
Staff Attorney



Oscar Espino-Padron
Associate Attorney

cc:

Mayor Eric Garcetti, City of Los Angeles
Councilmember Marqueece Harris-Dawson, City of Los Angeles 8th District
Chief Zoning Administrator Linn Wyatt, City of Los Angeles Department of City Planning
City Attorney Mike Feuer, Office of the Los Angeles City Attorney
General Manager Raymond S. Chan, Los Angeles Department of Building and Safety

PETITION INDEX

Footnote	Description	Tab
1	Office of Zoning Administration Notice of Public Hearing (Nov. 25, 2014).	A
2, 3	Letter from Huber E. Smutz, Chief Zoning Administrator, to Fred M. Anderson, Union Oil Company at 11 (Apr. 29, 1965).	B
4	LOS ANGELES, CAL., MUN. CODE § 12.27.1(A) (“MUN CODE”).	C
5	MUN. CODE § 11.00(c).	D
6	Letter from Anik Charron, Associate Zoning Administrator, RE: Approval of Plans – Determination of Methods and Conditions for Case No. ZA 17528(PA3), at 4 (Apr. 22, 2008).	E
7	MUN. CODE § 13.01(E)(2)(a)-(i); MUN. CODE § 13.01(K)(1)-(5); MUN. CODE § 13.01(F).	F
8	MUN. CODE § 12.27.1.	C
9	MUN. CODE § 13.18.	G
10	MUN. CODE § 11.00(l).	D
11	MUN. CODE § 12.27.1.	C
12	Letter from Huber E. Smutz, <i>supra</i> note 2, at 9.	B
13	Letter from Anik Charron, <i>supra</i> note 6.	E
14	<i>Population Density</i> , L.A. TIMES.	H
15	Letter from Huber E. Smutz, <i>supra</i> note 2, at 11.	B
16	Letter from Leonard S. Levine, Associate Zoning Administrator, RE: Approval of Plans – Determination of Methods and Conditions for Case No. ZA 17528(PAD), at 5 (Dec. 3, 1999).	I
17	Office of Zoning Administration, <i>supra</i> note 1.	A
18	Emily Alpert Reyes, <i>Neighbors Push Back Against Drilling Plan at South L.A. Site</i> , L.A. TIMES (Nov. 25, 2014); Molly Peterson, <i>Decision Delayed on Expanded Oil Drilling in West Adams</i> , SOUTHERN CALIFORNIA PUBLIC RADIO (Nov. 26, 2014); John Schreiber, <i>Zoning Officer Puts Off Decision on Urban Oil Field in South Los Angeles</i> , MY NEWS LA (Nov. 25, 2014).	J
19	Chemco Products Company.	K
20	Flo-kem, Odor Control Jasmine Safety Data Sheet.	L
21	WORLD HEALTH ORGANIZATION, STATE OF THE SCIENCE OF ENDOCRINE DISRUPTING CHEMICALS 2012: SUMMARY FOR DECISION-MAKERS (2012).	M
22	MUN. CODE § 13.01(K)(2).	F
24	Louis Sahagun, <i>Chemical Odor, Kids’ Nosebleeds, Few Answers in South L.A. Neighborhood</i> , L.A. TIMES (Sept. 21, 2013).	N
25	OFFICE OF ENVTL. HEALTH HAZARD ASSESSMENT AND AM. LUNG ASS’N OF CALIFORNIA, HEALTH EFFECTS OF DIESEL EXHAUST FACT SHEET.	O
26	Email from Matthias Lenz to Jojo Pewsawang (Nov. 21, 2014).	P

PETITION INDEX

Footnote	Description	Tab
27, 28	Office of Zoning Administration, <i>supra</i> note 1.	A
29	SCAQMD, Complaint Report, Complaint 238195 (Oct. 18, 2013).	Q
30	SCAQMD, Complaint Report, Complaint 244264 (July 15, 2014).	R
31, 32	SCAQMD, Report of Laboratory Analysis (July 16, 2014).	S
34	DOGGR, Permit to Conduct Well Operation 2 (May 29, 2014); Notice of Intention to Rework/Redrill Well 3 (May 29, 2014).	T
35, 36	AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, TABLE OF CHEMICAL CONSTITUENTS COMMONLY FOUND IN CRUDE OIL.	U
37	Mike Lee, <i>"That Stuff Can Get You So Fast"—Deadly Gas on The Rise in Oil Fields</i> , E&E REPORTER (Oct. 21, 2014).	V
38	TABLE OF CHEMICAL CONSTITUENTS COMMONLY FOUND IN CRUDE OIL, <i>supra</i> note 35.	U
39	SCAQMD, Update on Implementation of Rule 1148.2, at 42 (Nov. 12, 2014); Rule 1148.2 (d) notification for Event ID 2238.	W
40	Sahagun, <i>supra</i> note 24.	N
43	OFFICE OF ENVTL. HEALTH HAZARD ASSESSMENT AND AM. LUNG ASS'N OF CALIFORNIA, <i>supra</i> note 25.	O
44	Application for Determination of Methods and Conditions for Drilling Jefferson Controlled Drill Site (July 5, 2013).	X
45	SCAQMD, <i>supra</i> note 39, at 21.	M
46	<i>Id.</i> at 25.	M
47	MUN. CODE § 13.01(K)(2).	F
48	Sahagun, <i>supra</i> note 24.	N
49	MUN. CODE § 13.01(F)(18).	F
50	E-mail from Jennifer Redekopp to Jojo Pewsawang (Nov. 23, 2014).	Y
51	<i>"Routine" Planning Hearing Raises Questions About L.A.'s Oversight on Oil Drilling</i> , SOUTHERN CALIFORNIA PUBLIC RADIO (Nov. 24, 2014).	Z
52	Mathias Basner et al., <i>Auditory and Non-Auditory Effects of Noise on Health</i> , 383 Lancet 1325 (2014).	AA
53, 54	Ron Chepesiuk, <i>Decibel Hell: The Effects of Living in a Noisy World</i> , ENVIRON. HEALTH PERSPECT. A43 (2005).	BB
55	Basner, <i>supra</i> note 52, at 9.	AA
56	R. Timothy Weston & Tad Macfarlan, <i>Noise Regulation of the Shale Oil & Gas Extraction and Production Industry</i> , 6th Law of Shale Plays Conference, INSTITUTE FOR ENERGY LAW 4 (2015).	CC
57, 58	<i>Loudness Comparison Chart (dBA)</i> , CALTRANS.	DD
59	Email from Kara Clemins to Daniel Skolnick (Sept. 21, 2013).	EE

PETITION INDEX

Footnote	Description	Tab
60	Letter from Don Behrens, Behrens and Associates, Inc., to Edgar Salazar, RE: Ambient Noise Survey, Drilling Impact Evaluation and Mitigation Report (Feb. 15, 2006).	FF
61	Letter from Leonard S. Levine, <i>supra</i> note 16, at 4.	I
62	<i>“Routine” Planning Hearing</i> , <i>supra</i> note 51.	Z
63, 64	Ron Chepesiuk, <i>Missing the Dark: Health Effects of Light Pollution</i> , ENVTL. HEALTH PERSPECTIVES A20 (Jan. 2009).	GG
65-67	Letter from Leonard S. Levine, <i>supra</i> note 16, at 4.	I
68, 69	COMMUNITY HEALTH COUNCILS, OIL DRILLING IN LOS ANGELES: A STORY OF UNEQUAL PROTECTIONS 12 (2015).	HH

TAB A

CITY OF LOS ANGELES
CALIFORNIA



DEPARTMENT OF CITY PLANNING

NOTICE OF PUBLIC HEARING

To Owners: ☐ Within a 100-Foot Radius
☐ Within a 500-Foot Radius
☒ Abutting a Proposed Development Site

And Occupants: ☐ Within a 100-Foot Radius
☐ Within a 500-Foot Radius
And: ☐ Others

This notice is sent to you because you own property or are an occupant residing near a site for which an application, as described below, has been filed with the Department of City Planning. All interested persons are invited to attend the public hearing at which you may listen, ask questions, or present testimony regarding the project.

Hearing: Office of Zoning Administration

Date: Tuesday, November 25, 2014

Time: 1:00 p.m.

Place: Los Angeles City Hall
200 North Spring Street, Room 1020
(Enter from Main Street)
Los Angeles, CA 90012

Case No.: ZA 17528(PA4)
CEQA No.: ENV 2013-2058-CE
Council No.: 8
Plan Area: South Los Angeles
Zone: C2-1VL-D

Applicant: Freeport-McMoRan Oil & Gas, LLC

Representative: L. Rae Connet

Staff Contact: JoJo Pewsawang
Phone No.: (213) 978-214
JoJo.Pewsawang@lacity.org

PROJECT LOCATION: 1349-1375 West Jefferson Boulevard

REQUESTED ACTION: The Zoning Administrator will consider:

1. Pursuant to the provisions of Section 13.01-H of the Los Angeles Municipal Code, a Zoning Administrator's Determination/Approval of Plans to consider methods and conditions controlling drilling and production operations within the Jefferson Drill-site for the drilling of one new Class "B" well located in urbanized Oil Drilling District U-124; to re-drill one Class "A" well and to re-drill one Class "B" well, both within urbanized Oil Drilling District U-135.
2. Pursuant to Section 21084 of the California Public Resources Code, the above referenced project has been determined not to have a significant effect on the environment and which shall therefore be exempt from the provisions of CEQA.

The purpose of the hearing is to obtain testimony from affected and/or interested persons regarding this project. The environmental document will be among the matters considered at the hearing. The decision

maker will consider all the testimony presented at the hearing, written communication received prior to or at the hearing, and the merits of the project as it relates to existing environmental and land use regulations.

Exhaustion Of Administrative Remedies: If you challenge a City action in court, you may be limited to raising only those issues you or someone else raised at the public hearing described in this notice, or in written correspondence on these matters delivered to the Department before the action on this matter will become a part of the administrative record. Note: This may not be the last hearing on this matter.

Advice To Public: The exact time this report will be considered during the meeting is uncertain since there may be several other items on the agenda. Written communications may be mailed to the Los Angeles City Planning Department, Office of Zoning Administration, 200 N. Spring Street, Room 763, Los Angeles, CA 90012 (attention: JoJo Pewsawang).

Review Of File: The file, including the application and the environmental assessment, are available for public inspection at this location between the hours of 8:00 a.m. to 4:00 p.m., Monday through Friday. Please call (213) 978-1318 several days in advance to assure that the files will be available. The files are not available for review the day of the hearing.

Accommodations: As a covered entity under Title II of the Americans with Disabilities Act, the City of Los Angeles does not discriminate on the basis of disability. The hearing facility and its parking are wheelchair accessible. Sign language interpreters, assistive listening devices, or other auxiliary aids and/or services may be provided upon request. Other services, such as translation between English and other languages, may also be provided upon request.

To ensure availability of services, please make your request no later than three working days (72 hours) prior to the hearing by calling the staff person referenced in this notice.

Como entidad cubierta bajo el Título II del Acto de los Americanos con Desabilidades, la Ciudad de Los Angeles no discrimina. La facilidad donde la junta se llevará a cabo y su estacionamiento son accesibles para sillas de ruedas. Traductores de Lengua de Muestra, dispositivos de oído, u otras ayudas auxiliares se pueden hacer disponibles si usted las pide en avance. *Otros servicios, como traducción de Inglés a otros idiomas, también pueden hacerse disponibles si usted los pide en avance.*

Para asegurar la disponibilidad de éstos servicios, por favor haga su petición al mínimo de tres días (72 horas) antes de la reunión, llamando a la persona del personal mencionada en este aviso.

TAB B

CITY OF LOS ANGELES
CALIFORNIA

HUBER E. SMUTZ
CHIEF ZONING ADMINISTRATOR

ASSOCIATE ZONING ADMINISTRATORS

CHARLES V. CADWALLADER
ARTHUR DVORIN
R. A. RUDSER



SAMUEL WM. YORTY
MAYOR

DEPARTMENT OF
CITY PLANNING

OFFICE OF
ZONING ADMINISTRATION

400 CITY HALL
LOS ANGELES, CALIF. 90012
MADISON 4-5211

April 29, 1965

HS-
mh

Union Oil Company
ATTENTION: Fred M. Anderson, Mgr.
Properties Administration
P. O. Box 7600
Los Angeles 54, California

Fire Prevention Bureau

Department of Building & Safety

Re: Z.A. CASE NO. 17528
N'ly of Jefferson Blvd.
between Sudlong Ave.
& Van Buren Place
Oil Drilling District
No. U-124
D. M. No. 4306

Greetings:

In the matter of the application of the Union Oil Company, owners and lessees, for approval of a controlled drill site and for determination of conditions and methods of operation to be followed in drilling for and production of oil and gas on an approximately 2-acre site classified in the C2 and RS-1 Zones in impending Oil Drilling District No. U-124, please be advised that based upon the Findings of Facts hereinafter set forth and by virtue of authority contained in Section 13.01-E, F and H of the Municipal Code, the Chief Zoning Administrator hereby authorizes the use of a site comprising:

Lots 1, 2, 3, 4, 7, 8, 9, 10, 21, 22, 23 and 24, Block 4, Peole and Jones Tract, except the westerly 30 ft. of said Lots 1 and 2, and including the 15 ft. in width public alley along the northerly portion of said Lots 2 and 3 as authorized by the Board of Public Works;

located northerly of Jefferson Boulevard between Sudlong Avenue and Van Buren Place, Santa Barbara District, as a controlled drill site on which to drill wells and conduct surface operations in connection with the development and bottoming of wells under impending Oil Drilling District U-124 consisting of that 159-acre drilling district depicted and described on the map which is a part of Ordinance No. 129760, as well as for surface operations in connection with wells which by subsequent action may be authorized to be bottomed under adjoining and adjacent districts, and also authorizes the drilling, completion and maintenance on said controlled drill site of not to exceed two

exploratory wells bottomed under said District U-124 and for the production from said wells, if successful, of oil, gas, and other hydrocarbon substances and to maintain such equipment and accessories as are necessary in the drilling for and the production of oil, gas, and other hydrocarbon substances, upon the following terms and conditions:

1. That all the conditions set forth in Section 13.01-E, 2 as well as Conditions Nos. 1, 3, 4, 5, 8, 9, 17, 18, 33, 37, 40, 43, 47, 49, 50, 54, 58 and 59 of Subsection F of Section 13.01 of the Municipal Code are included in and by reference made a part of this approval and shall be complied with to the same extent as if herein restated in detail.
2. That in no event shall the base of the derrick used in drilling operations project more than 1 ft. above the highest elevation of the existing public sidewalk along Jefferson Boulevard adjacent to the southerly side of the site. Furthermore, that the derrick utilized for drilling operations shall consist of the new-style derrick such as depicted on the plans submitted with the application and which does not employ the usual 'gin pole' house extending above the crown block and upper platform and similar to that currently being utilized by the applicant on the extant drill site in District U-33, and in no event shall the overall gross height of said derrick and acoustical quilt covering the same exceed a height of 141 ft. above the sidewalk elevation referred to above. It is understood the standard 130 ft. derrick used in this operation shall be shortened by redesigning to meet the height limitations specified above. Furthermore, that tanks and other equipment and buildings used in drilling and production activities shall be located on the site in such manner that no portion of the tanks, equipment, or buildings, other than the upper portion of the derrick, drawworks house and drilling equipment buildings, temporary mud and water storage tanks and future portable drilling mast used for servicing activities, will extend for any appreciable distance above the enclosing fence or wall surrounding the drilling site as hereinafter specified.
3. That the land from the subject drill site necessary for the widening of Jefferson Boulevard to its designated secondary highway width shall be dedicated and improved or suitably guaranteed in a manner and under the procedures provided in Section 12.37 of the Municipal Code. The controlled drill site shall be enclosed with an ornamental masonry wall having a height of at least 7 ft. above the level of the adjacent property outside of the

of the future oil wells indicated on said Exhibit 13 and that greater setbacks may be specified by the Fire Department in compliance with provisions of Article 7, Chapter 5 of the Municipal Code. The nature of projections permitted in the building line spaces established by ordinance on the "R" zoned lots abutting both Van Buren Place and Budlong Avenue shall be as specified in the grant under companion Yard Variance Case No. 13903.

5. That in addition to soundproofing the derrick and other structures as required by Condition No. 47 of said Section 13.01-F, soundproofing shall also be provided for the electrical distribution center and control house containing automatic electric switches and for the engine, shakers, and mud pumps and for the doors providing ingress and egress to the derrick, and that said doors be kept closed except for short intervals when actually being used for ingress and egress purposes and for placing or removing materials and supplies in or from the derrick. Furthermore, that the manner in which the soundproofing is to be accomplished, including a plot plan specifying location of involved buildings or structures and tanks, landscaping of premises, location and type of surfacing on access driveways and other details for the development of the site, together with plans for each of the buildings and tanks to be placed on the site, shall be submitted to and approved by a Zoning Administrator prior to the issuance of the drilling permit for each of the proposed wells and prior to issuance, respectively, of permits for any such buildings or tanks; said soundproofing material as required above to be of a fire resistive type approved by the Los Angeles Fire Department. If an acoustical quilt type covering is utilized to soundproof the derrick and buildings, said quilt covering shall be stretched tight, hung and maintained in such manner that it will have a tight attractive non-sagging appearance.
6. That the upper portions of the soundproofed derrick which extend above the walls surrounding the drilling site shall be painted and camouflaged in such manner as to blend into the adjacent buildings, landscaping and sky, or present the appearance of an attractive monument rather than a covered oil derrick. The designs of such camouflage treatment shall be submitted to the Administrator for approval with plans for soundproofing the derrick, and thereafter the upper portions of the derrick shall be treated and maintained in the manner suggested and approved, all of which shall be designed to eliminate as far as practical the

enclosing fixtures, said enclosing fixture to observe a minimum setback of 10 ft. from the widened line of Jefferson Boulevard, the easterly line of Van Buren Avenue and the westerly line of Budlong Avenue, except adjacent to the existing building fronting Jefferson Boulevard on the southwesterly corner of the site which, if desired, may be retained in its present position. Furthermore, that the setback spaces along all street frontages including the space out to the curb line not utilized for driveways or public sidewalks shall be landscaped by the planting of lawn, ivy or other green ground cover interspersed with trees and shrubs, all of said landscaping to be maintained in first-class, attractive condition at all times. Included in the landscaping of the site, specimen ornamental street trees of a broadleaf evergreen type or cocoa palmetto palms shall be planted and maintained in the parkway spaces along both Van Buren Place and Budlong Avenue, all in a manner satisfactory to the Street Tree Division, Bureau of Street Maintenance. Furthermore, in the event that the oil drilling program is successful and the site is to be retained and utilized for other oil wells and for production purposes as herein or hereafter authorized, there shall be transplanted near the northerly and southerly corners of the landscaped setback spaces adjacent to the "R" zoned portion of the site along both Van Buren Place and Budlong Avenue, tall trees such as Washingtonia palms or Canary Island pines which at the time of transplanting are approximately 50 ft. in height so as to partly screen out or interrupt the conspicuousness of the lower half of the derrick from adjacent property. It is understood that gates in the enclosing wall around the drill site across entrance and exit driveways shall be covered with solid material colored to match that of the enclosing wall.

4. That as long as the subject site is utilized for oil drilling and production purposes, Lots 11 and 20, Block 1, Cooke and Jones Tract, adjoining the northerly side of the site shall be retained in common ownership with the site and the existing dwellings on said lots or suitable replacements thereof conforming to zoning regulations shall be retained to serve as a buffer between the site and the adjacent lots to the north. Furthermore, that the oil well drilling equipment and future production equipment shall be located on the site in substantial conformity to the plot plan Exhibit 12 attached to the file with any oil well located at least 50 ft. from the exterior property lines of the site. It is understood that this initial grant does not authorize all

conspicuousness of the derrick from the adjacent residential areas. It is understood that the same type of derrick design and camouflage treatment thereof heretofore approved for the drilling operation now in progress on the drill site in District U-3d may be utilized on the drilling site here in question. However, if the first test wells upon the site prove to be successful and additional wells are to be drilled thereon, then, considering the conspicuousness of the drill site from adjacent residential areas, and if deemed necessary by the Chief Zoning Administrator, any acoustical quilt type covering for the first test well equipment shall either be replaced or covered with a more rigid permanent type of attractive soundproof enclosing fixture giving the derrick more the appearance of a monument, all in keeping with plans approved by the Chief Zoning Administrator.

7. That a parking area shall be provided on the drilling site for use by vehicles employed in drilling and maintaining of oil wells on the property, and a similar parking area shall be provided on the drill site or immediately adjacent thereto in the C2 Zone for the parking of automobiles of employees engaged in the drilling and production activities. The driveways necessary on the drilling site, as well as the required employee and equipment parking area, shall be paved with rock and oil or asphaltic paving materials suitable to withstand heavy trucking operations, and that all such driveways and parking areas shall be regularly washed down, swept or otherwise kept free of accumulated cement, dust, or other materials which would produce dust in the use of said facilities.
8. The drilling of the wells shall be conducted in accordance with good oil field practice and the latest techniques and refinements in equipment and materials shall be used. The latest and most effective blow-out prevention equipment shall be installed and maintained in connection with the drilling of any well.
9. That as further amplification of Condition No. 49 of Section 13.01-F of the Municipal Code, except for actual drilling and production operations, no work shall be conducted on the property between the hours of 7:00 P.M. of one day and 7:00 A.M. of the following day or on Sundays.
10. That in no event shall drilling operations be carried on or conducted on the site in connection with more than one well at a time and not more than two exploratory

oil wells shall be drilled under this authorization and bottomed under said District U-124. It is understood that as provided in the respective ordinances, the Administrator under separate applications, may permit exploratory or production wells under adjoining or adjacent districts, and as provided in Paragraph 2, Paragraph (dt), Section 13.01-G,2 of the Municipal Code, the Administrator under separate application, may approve additional wells upon this drill site after considering the recommendation of the City Administrative Officer based upon results of the exploratory well or wells. Furthermore, that prior to the approval or issuance of Fire Department permits for each well to be drilled upon the subject site, there shall be supplied to the Zoning Administrator a map showing the general direction and general bottom hole location of said proposed well so that proper records can be kept as to the number of wells bottomed and completed under said district in compliance with the terms of this grant and the provisions of Paragraph (c), Section 13.01-E,2 of the Municipal Code. Furthermore, the applicants or operators of the oil drilling activities herein authorized, upon request by the Chief Zoning Administrator, shall furnish such additional information concerning the status, exact bottom hole location, productivity, etc., of the various wells drilled from the property, as to enable the Administrator to properly and intelligently administer the oil drilling regulations in this area; said information to be either verbal or in writing and to be kept confidential by the Administrator if so desired by the applicants.

11. That if any of the wells hereby or hereafter authorized are successful and are to be maintained as producing wells and are required to be pumped, then said wells shall be equipped with Kobe or comparable producing units which shall be placed in pits or cellars below the surface of the ground so that no visible pumping units will be above the ground adjacent to the surface location of the wells and that wells shall be serviced with only portable type equipment. Furthermore, that the triplex pump units necessary to operate the Kobe or comparable oil well pumping units as well as the compressors for compressing the gas to meet pipeline specifications, shall be housed in substantial buildings which have been acoustically treated so as to be substantially soundproofed.
12. That all oil and gas produced from the wells on the property shall be transported from the drilling site only by means of underground pipeline connected directly

with the producing pump or with tanks or treating facilities by a completely closed system without venting products to the atmospheric pressure at the production site and in no event shall there be any storage or treatment facilities on the property other than necessary to conform production to pipeline requirements. In no event shall more than three-day storage or two 1,000-bbl. tanks, whichever is greater, be erected or maintained on the property. Furthermore, that said production tanks shall be so placed and located with respect to enclosing fixtures surrounding the site as to not be visible to persons on adjacent public streets or from adjacent residential property having approximately the same ground level elevation as the average ground level surrounding the drill site.

13. That all tools, pipe and other equipment in connection with the drilling and production activities shall be stored and kept on the drilling site within the walled and landscaped enclosure.
14. After completing the exploratory test wells herein authorized, and provided authorization has been given for additional wells within the drilling site, the bores of additional wells shall be projected directionally under District No. U-124 and adjoining districts if and when authorized under said districts so that a complete and adequate test of the location, extent, character, density and productivity of any producing oil zones may be had from the single drill site area. Said additional wells shall be drilled with due diligence so as to complete the total number of wells authorized within the shortest possible time, utilizing only one oil drilling derrick for said operations. Furthermore, that upon completion of each well, the derrick shall be removed or moved to the site for a new well on the drilling site and work started toward drilling said new well within the 30-day period referred to in Condition No. 4, Section 13.01-F, to the end that the derrick and drilling operations will be removed and discontinued on the site in the shortest period of time possible.
15. That any owner, lessee or permittee and their successors and assigns, as well as the concern which is to actually do the drilling work, if different than the above, must at all times be insured to the extent of \$2,000,000 against liability in tort and public liability and property damage arising from drilling or production, or activities or operations incident thereto, conducted or carried on under or by virtue of the conditions prescribed for this district and by written

determination by the Administrator as provided in Subsection H of Section 13.01 of the Los Angeles Municipal Code. The policy of insurance issued pursuant hereto shall be subject to the approval of the City Attorney and duplicates shall be furnished to him. Each such policy shall be conditioned or endorsed to cover such agents, lessees, or representatives of the owner, lessee or permittee as may actually conduct drilling, production or incidental operations permitted by such written determination by the Administrator. A certificate of insurance carrier and its address and a sworn statement that such insurance will be maintained in full force and effect, shall be furnished the Chief Zoning Administrator before any permits are issued.

15. That the surety bond in the sum of \$5,000 required by Condition No. 3 of the above-mentioned Subsection F and Condition (g) under Section 13.01-2,2 of the Municipal Code shall be approved by the City Attorney, executed by both the applicants and any lessee who is to do the actual oil drilling and filed with the Chief Zoning Administrator before any permit is issued.
17. The operator, after drilling each well to a depth of approximately 2,000 ft., shall take an electric log of the well to that depth, analyze the log and provide the Department of Water and Power of the City of Los Angeles with a copy of said log, together with its interpretation, showing aquifers and an estimate of the salinity of all waters encountered. From the information so obtained, a joint determination shall be made of the required depth at which the surface casing shall be cemented. Sufficient cement shall be used to reach the ground surface behind the surface casing. On completion of the drilling program, another log shall be taken and analyzed and, if necessary, additional steps shall be taken to prevent the vertical movement of brine into fresh water zones. In the event no commercial production of oil is obtained, cement plugs shall be used to protect all fresh water in abandonment of the well. A conference between the operator and officials of the Department of Water and Power may waive the requirement for a log on each well, if sufficient subsurface data is obtained from previous logs to permit it to carry out the purpose of this condition.
18. That the public water supply system on the property shall be protected against backflow where necessary in a manner acceptable to the Departments of Health and Water and Power and meeting the requirements of the Uniform Plumbing Code. Furthermore, representatives

of the said Departments may enter upon the premises at any reasonable time for routine investigation of operations and/or facilities shall be made within a reasonable time as determined by the investigator.

19. That the drilling site and approaches thereto shall at all times be kept in a clean, neat-appearing condition free from weeds and debris, other than necessary and incidental drilling equipment and supplies, and shall be effectively landscaped and maintained as required under various applicable conditions heretofore mentioned and in compliance with plans approved by the Chief Zoning Administrator. In this instance, special attention shall be given to effective housekeeping so as to prevent any accumulation of oil, oil products, or oil-coated boards, materials, or equipment which might cause fumes or odors detrimental to the adjoining dwellings. Furthermore, that upon completion of the drilling operations, all equipment and supplies, except that actually necessary in production work and as specified on plans for the installation of the various production facilities and devices, shall be removed from the property so that as far as practicable, there be no evidence above the ground of the presence of the oil producing facilities in the pits and cellars heretofore specified.
20. That if oil drilling and production is successful on the subject property and there is any evidence that the production activities cause noticeable subsidence in the present elevation of the ground on the subject property or in the vicinity, then the Chief Zoning Administrator, after consultation with recognized experts in connection with this problem, shall have authority to require corrective action, such as repressurizing the oil producing structure or the cessation of oil drilling and production.
21. That the Chief Zoning Administrator reserves the right to impose additional conditions or require corrective measures to be taken if he finds after actual observation or experience with drilling one or more of the wells on the subject property that additional conditions are necessary to afford greater protection to adjacent or surrounding property as intended by the provisions of Section 13.01 of the Municipal Code, as well as the conditions set forth in Ordinance No. 127760.

The applicants' attention is called to the fact that this determination is not a permit or license, and that any permits and licenses required by law must be obtained from the proper public agency. Furthermore, that if any condition of this grant

is violated, or if the same be not complied with in every respect, then the applicants or their successors in interest may be prosecuted for violating these conditions the same as for any violation of the requirements contained in the Municipal Code. If this property is subleased or assigned to another oil company for drilling or production purposes, it is incumbent upon the applicants to notify said sublessee or assignee of the terms and conditions described above and that the sublessee or assignee must assume all said conditions to the satisfaction of the Administrator. The Chief Zoning Administrator's determination in this matter will become effective after an elapsed period of ten (10) days from the date of this communication, unless an appeal therefrom is filed with the Board of Zoning Adjustment.

FINDING OF FACTS

After thorough consideration of the statements contained in the application, the proceedings in connection with City Plan Case No. 13002 which resulted in enactment of Ordinance No. 129760 creating Oil Drilling District No. U-124, several City Plan Cases involving adjoining and adjacent oil drilling districts, Z. A. Cases Nos. 15227, 15591 and 16773 which authorized the development and use of the controlled drill sites located in Oil Drilling Districts U-37 and U-38, both to the northwest, and Yard Variance Case No. 13503 which is a companion to the subject application, all of which are by reference made a part hereof, as well as recent personal inspection of the subject property, the surrounding neighborhood, and the oil drilling and production methods being employed on the controlled drill site here in question, and conference with the applicant's representatives, I find as follows:

1. The property to be used as the controlled drilling site from which all activity will be conducted for bottoming wells under District U-124 and also under some of the adjoining and adjacent districts if production is discovered, involves an essentially vacant parcel of land from which all the former buildings have been removed except for one located on the commercially zoned portion of the site. It is the site which was contemplated for use in connection with bottoming wells under the district in question and discussed in the recent proceedings before the City Planning Commission and City Council which led up to adoption of the ordinance. More than 80% of the property within the district is incorporated in a community oil and gas lease held by the applicant but consisting of property which is almost solidly developed with single and multiple-family dwellings classified in the R1 and R2 zones except for the

commercially zoned and developed property along the Jefferson Boulevard, Vermont Avenue and Adams Boulevard frontages. Although it would have been more satisfactory had it been possible to complete exploration for wells under the subject district from the developed drill site in District U-37, it has been ascertained that the potentially shallow oil producing horizon under this district cannot be reached by slant drilling methods from said drill site and that some other site must be utilized for this purpose. There is no really logical controlled drill site in the district. The subject site is centrally located to reach the objective and at the behest of the Department of Building and Safety in connection with its Conservation Program, the former substandard dwellings and commercial buildings were removed from the site so that it now offers an open area available for this use.

2. The site protrudes from the commercially zoned frontage along Jefferson Boulevard into the residential area northerly thereof, with the applicant having obtained permission from the Board of Public Works to incorporate the unimproved alley in the drill site. The applicant owns the two immediately adjoining lots to the north and has agreed to maintain the existing dwellings thereon as a buffer between the proposed activities and the residential development to the north in the same block. However, considering the solidly developed residential lots fronting into the site on both Van Buren Place and Sudlong Avenue and the close proximity of the densely developed residential section and adjacent built-up commercial area, all features of oil drilling and production must be strictly controlled to eliminate any possible odor, noise, vibrations, hazards, unsightliness, and extensive truck traffic which might possibly affect the surrounding residential and intensively developed commercial district. It has been proven by experience and particularly with the drilling and production operations now being carried on at other controlled drill sites in urbanized portions of the City, including the applicant's current operations on the drill sites in Districts U-37 and U-38 located respectively, one mile and two miles to the northwest, that all the normal objectionable features of oil drilling and production can be controlled so as to cause no detriment to surrounding property except the conspicuous feature of the oil drilling derrick which must remain on the property during the process of drilling the several wells permitted.

Revised design, camouflage treatment and well placed landscaping have been successfully employed in other areas to eliminate the conspicuousness of the derrick. In view of all the above considerations, the conditions imposed are necessary and within the intent and purpose of Section 13.01-3 and 7 of the Municipal Code to protect and preserve the surrounding area for continued residential and commercial development in keeping with the zoning and to protect the general public and the community from any detrimental features of oil drilling. Furthermore, some of the conditions are necessary to protect the health and underground water supply of the community, as suggested by the Chief Engineer and General Manager of the Department of Water and Power.

Very truly yours,

HUBER E. SMUTZ
Chief Zoning Administrator

HES:es

cc: Director of Planning
Lyall A. Pardee, City Engineer
Public Utilities & Transportation
Attention: Thos. V. Tarbet
Petroleum Administrator
Street Tree Division
Bureau of Street Maintenance
RE Thompson
County Health Department
State Regional Water Pollution
Control Board No. 4
Councilman Billy G. Mills

TAB C

CITY OF LOS ANGELES MUNICIPAL CODE
§ 12.27.1 ADMINISTRATIVE NUISANCE ABATEMENT PROCEEDINGS.
(Amended by Ord. No. 180,409, Eff. 1/18/09.)

A. Purpose. It is the intent of this section to consolidate a number of existing code provisions relating to the administrative abatement of public nuisances, and revocations, rescissions, discontinuances or modifications of discretionary zoning approvals. In addition, this section also sets forth procedures allowing the Director to modify or remove conditions imposed as a result of nuisance abatement proceedings; to enforce conditions imposed as part of any discretionary zoning approval; and to require that the cost of a proceeding instituted pursuant to this section be paid by those responsible for the maintenance and operation of the subject use.

These provisions allow the City's zoning authorities to protect the public peace, health and safety from any land use which becomes a nuisance; adversely affects the health, peace or safety of persons residing or working in the surrounding area; or violates any land use related condition imposed pursuant to this chapter or other provision of law, while protecting the constitutional rights of the parties involved.

B. Authority. Notwithstanding any other provision of this Code to the contrary, the Director may require the modification, discontinuance or revocation of any land use or discretionary zoning approval if it is found that the land use or discretionary zoning approval as operated or maintained:

1. Jeopardizes or adversely affects the public health, peace, or safety of persons residing or working on the premises or in the surrounding area; or
2. Constitutes a public nuisance; or
3. Has resulted in repeated nuisance activities, including, but not limited to, disturbances of the peace, illegal drug activity, public drunkenness, drinking in public, harassment of passersby, gambling, prostitution, sale of stolen goods, public urination, theft, assaults, batteries, acts of vandalism, loitering, excessive littering, illegal parking, excessive loud noises (especially in the late night or early morning hours), traffic violations, curfew violations, lewd conduct, or police detentions and arrests; or
4. Adversely impacts nearby uses; or
5. Violates any provision of this chapter; or any other city, state, or federal regulation, ordinance, or statute; or
6. Violates any condition imposed by a prior discretionary land use approval including approvals granted pursuant to Sections 12. 24, 12. 27, 12. 28, 12. 32 or 14. 00 of this Code; or an approval initiated by application of a property owner or owner's representative related to the use of land including, but not limited to, parcel map, tentative tract map, coastal development permit, development agreement, density transfer plan, exception from a specific plan, and project permit pursuant to a moratorium or an interim control ordinance.

C. Procedures: Notice, Hearings and Appeals. The Director shall give notice to the record owner and lessee(s) of the real property affected to appear at a public hearing at a time and place fixed by the Director and show cause why the land use or discretionary zoning approval should not be modified, discontinued, or revoked.

1. Notice. A written notice shall be mailed not less than 24 calendar days prior to the date of hearing to the owner and lessee(s) of the property involved, and to the owners of all property within and outside of the City that is within 500 feet of the exterior boundaries of the property involved, using for the purpose of notification the last known name and address of the owners, as shown in the City Clerk's records or in the records of the County Assessor. If all property within the 500-foot radius is under the same ownership as the property involved in the proceeding, then the owners of all property which adjoins that ownership shall be included in this notification. Written notice shall also be mailed to residential, commercial and industrial occupants of the property involved, and all property within 500 feet of the exterior boundaries of the property involved. This requirement can be met by mailing the notice to "occupant". If this notice provision will not result in notice being given to at least 20 different owners of at least 20 different lots other than the subject property, then the 500-foot radius for notification shall be increased in increments of 50 feet until the required number of persons and lots are encompassed within the expanded area. Notification shall then be given to all property owners and occupants within the expanded area.

Notwithstanding the above 24-calendar day notification period and the 500-foot notification radius, only 15 calendar days and a 500-foot radius shall be required for any hearing conducted on the same site for a land use or discretionary zoning approval for which a previous final decision pursuant to this section has been made by the City.

2. Hearing and Decision. The matter may be set for public hearing before the Director. After the conclusion of a public hearing, the Director may require the modification, discontinuance or revocation of the land use or discretionary zoning approval, as the case may be. As part of the action, the Director may impose conditions of operation as he or she deems appropriate, including those necessary to protect the best interests of the surrounding property or neighborhood; to eliminate, lessen, or prevent any detrimental effect on the surrounding property or neighborhood; or to assure compliance with other applicable provisions of law or conditions of an earlier discretionary approval. Conditions imposed may include the establishment of amortization schedules, the closure or removal of buildings or structures, and affect the establishment, maintenance, or operation of the subject use, and related land uses, buildings, or structures.

Whenever the Director initiates an action pursuant to this section he or she shall impose a condition requiring payment of the fee set forth in Section 19. 01 P. of this Code (fee condition) to cover the City's costs in processing the matter. A fee is not required if the Director finds that the operation of the land use does not create a nuisance or that the property owner, business operator or person in control, is in substantial compliance with the conditions of operation. The fee condition shall further provide that if the decision is not appealed, then the fee shall be paid in full to the City with confirmation of the payment being provided to the Director within 30 days of the decision date. If an appeal is filed and the decision of the Director is upheld on appeal, then the fee shall be paid in full with confirmation made to the Director within 30 days of the effective date of the decision. If the Council reverses in total the decision of the Director, then no payment of fees other than the appeal fee specified in Section 19. 01 P. shall be required.

Any determination shall be supported by written findings, including a finding that the Director's determination does not impair the constitutional rights of any person. The written determination shall also state that failure to comply with any or all conditions imposed may result in the issuance of an

order to discontinue or revoke the land use or discretionary zoning approval. The Director may require the discontinuance or revocation of a land use or discretionary zoning approval only upon finding that:

(a) prior governmental efforts to cause the owner or operator to eliminate the problems associated with the land use or discretionary zoning approval have failed (examples include formal action, such as citations, orders or hearings by the Police Department, Department of Building and Safety, the Director, a Zoning Administrator, the City Planning Commission, or any other governmental agency); and

(b) the owner or operator has failed to demonstrate, to the satisfaction of the Director, the willingness or ability to eliminate the problems associated with the land use or discretionary zoning approval.

If the Director discontinues or revokes any land use or discretionary zoning approval pursuant to this section, the full cost of the abatement, including the cost of inspection, shall become the personal obligation of the business operator, property owner, or person in control. If confirmed by the Council, a lien may be placed against the property in accordance with the procedures described in Administrative Code Sec. 7. 35. 3.

3. Compliance Review. Upon any finding of nuisance or non-compliance with existing conditions imposed on the land use or discretionary zoning approval, the Director's determination shall impose a condition requiring the business operator or property owner to file a Plan Approval application for Review of Compliance with Conditions within two years of the effective date. At the discretion of the Director, the due date for the Plan Approval application can be set for 90 days, 180 days, one year, 18 months or two years from the effective date of the Director's determination or the Council action on appeal.

4. Appeals. An appeal from the decision of the Director may be taken to the Council in the same manner as prescribed in Section 12. 24 I.

An appeal fee shall be charged pursuant to Section 19. 01 P. The Council's decision on appeal shall be processed in the manner prescribed in Section 12. 24 I. 6.

Further, if it is determined by the Council that the decision of the Director impairs the constitutional rights of any person, then it shall modify the action accordingly, or refer the matter back to the Director for further action.

5. Violations. It shall be unlawful to violate or fail to comply with any requirement or condition imposed by the Director or the Council pursuant to this section. Violation or failure to comply shall constitute a violation of this chapter and shall be subject to the same penalties as any other violation of this chapter. In the event of a violation of an order to discontinue or revoke a land use or discretionary zoning approval pursuant to this section, the Department of Building and Safety shall order the owner to vacate and secure the property, premises, buildings or portion of any property, premises or building pursuant to Section 91. 9003 of this Code. The Department of Building and Safety shall institute enforcement as provided in Section 91. 9003. 3 of this Code. The Director shall cause the determination or revocation to be recorded.

D. Residential Uses. This subsection shall apply to all single-family and multi-family residential uses, including residential hotels as defined in Section 47. 73 T. of this Code. This subsection shall not apply to hotels or motels that are not residential hotels. Nothing in this section or Section 91. 9001 et seq. of this

Code is intended to supersede or abrogate the rights of tenants provided by State statute or by the Los Angeles Housing Code and Rent Stabilization Ordinance, or by any other provision of this Code.

1. The Director, as the initial decision maker, or the Council on appeal, shall ask the City Attorney to initiate the process of having the residential use placed in receivership pursuant to California Civil Code Section 3479 and Code of Civil Procedure Section 564(b)(9), upon finding that:

(a) prior governmental efforts to cause the owner or operator to eliminate the problems associated with the land use or discretionary zoning approval have failed (examples include formal action, such as citations, orders or hearings by the Police Department, Department of Building and Safety, the Director, a Zoning Administrator, the City Planning Commission, or any other governmental agency); and

(b) that the owner or operator has failed to demonstrate, to the satisfaction of the Director, the willingness or ability to eliminate the problems associated with the land use or discretionary zoning approval.

2. If the residential use is not placed in receivership and the Director, as the initial decision maker, or the Council on appeal, discontinues or revokes the land use or discretionary zoning approval, resulting in the displacement of tenants then the following provisions shall apply: (Amended by Ord. No. 182,718, Eff. 10/30/13.)

(a) The Housing and Community Investment Department shall identify each tenant who was displaced and is eligible for relocation assistance, and shall issue an order requiring the owner to pay relocation benefits in the amounts specified in Section 151. 09 G. of this Code.

(b) If the owner fails to pay relocation benefits to an eligible tenant as required by this subsection, the Housing and Community Investment Department may advance relocation benefits to the tenant in the amount set forth in Section 151. 09 G. of this Code.

(c) If the owner fails to comply with an order of the Housing and Community Investment Department to pay relocation benefits, the owner shall be liable to the City for any relocation payments advanced, and the Housing and Community Investment Department may obtain a lien upon the property pursuant to Los Angeles Administrative Code Section 7. 35. 3 to recover the amount advanced and associated costs.

(d) Relocation benefits shall not be payable to any tenant who has caused or substantially contributed to the condition giving rise to an order to vacate issued pursuant to Section 91. 9003. 1 of this Code. The Director shall determine whether a tenant has caused or substantially contributed to the condition giving rise to the order to vacate.

(e) The Housing and Community Investment Department shall inform each eligible tenant of his/her right to re-rental of the same unit, or comparable unit, if the owner, or subsequent owner, re-establishes the residential use. The Housing and Community Investment Department shall inform the eligible tenant that he/she must advise the owner in writing of his/her interest in re-renting and must provide the owner with an address to which the owner can direct an offer.

(f) When the residential use is re-established, the accommodations shall be offered, and rented or leased at the lawful rent in effect at the time the residential use was discontinued or revoked, plus annual adjustments available under Section 151. 06 of this Code.

(g) The Director's determination or the Council's action shall include the provisions of this subsection and shall be recorded by the Director as a covenant with the Office of the County Recorder.

E. Modification of Administrative Decisions. Any administrative nuisance abatement decision made pursuant to this chapter, any conditions imposed by that decision, or any decisions on a discretionary zoning approval pursuant to this section may be modified pursuant to the provisions of this subsection. Upon application by the business operator, property owner or lessee(s), the Director may modify or eliminate the conditions of a prior decision. An application shall be made on official forms provided by the Department of Planning and shall be accompanied by a filing fee as specified in Section 19.01 P.

An application may be considered if a time period of at least one year has passed from the date the conditions were originally imposed; or if there have been substantial changes in the nature and operation of the land use or discretionary zoning approval; or if there has been a change in circumstances such that the continued enforcement of the previously imposed conditions is no longer reasonable or necessary. All applications shall include a radius map, a list of property owners and occupants within 500 feet, and plot plan drawn to scale.

An application shall be set for public hearing. The Director may grant or deny the requested application, or modify the prior decision, including imposing new or different substitute conditions as the Director deems appropriate. No modification shall be approved pursuant to this subsection unless the Director finds each of the following:

1. That the requirements for consideration of the application under this subsection have been met; and
2. That due consideration has been given to the effects of the modification on surrounding properties.

An appeal from the decision of the Director may be taken to the Council in the same manner as prescribed in Subsection C. of this section.

When the Director orders the discontinuance or revocation of a land use or discretionary zoning approval and the applicant files for re-instatement of the land use pursuant to this subsection, the Director may re-instate the land use if all findings of this subsection are met. The applicant will not be issued a new certificate of occupancy.

Subsequent applications for reconsideration may be filed in accordance with this subsection. If the application is denied with prejudice, a subsequent application for reconsideration shall not be filed within one year from the reconsideration decision date, and then only if a property owner, business operator or lessee(s) shows that the circumstances involving the land use or discretionary zoning approval have substantially and materially changed since the last reconsideration.

F. Continuation of Prior Decisions. Prior administrative nuisance abatement decisions regarding land uses and discontinuances, revocations, rescissions or modifications of discretionary zoning approvals made by the Zoning Administrator, City Planning Commission or the Council shall remain in full force and effect. Further, it shall continue to be unlawful to violate or fail to comply with any prior requirement or condition imposed by the Zoning Administrator, the former Board of Zoning Appeals, the City Planning Commission, or the Council. Violation or failure to comply shall constitute a violation of this chapter and shall be subject to the same penalties as any other violation of this chapter. In the event of a violation of

an order of discontinuance or revocation, the Department of Building and Safety shall order the business operator, property owner or lessee(s) to vacate and secure the property, premises, buildings or portion thereof pursuant to Section 91. 9003 of this Code. The Department of Building and Safety shall institute enforcement as provided in LAMC Sec. 91. 9003. 4 of this Code.

TAB D

CITY OF LOS ANGELES MUNICIPAL CODE
§ 11.00 – PROVISIONS APPLICABLE TO CODE.
(Amended by Ord. No. 175,676, Eff. 1/11/04.)

(c) Construction. The provisions of this Code and all proceedings under it are to be construed with a view to effect its objectives and to promote justice.

(l) In addition to any other remedy or penalty provided by this Code, any violation of any provision of this Code is declared to be a public nuisance and may be abated by the City or by the City Attorney on behalf of the people of the State of California as a nuisance by means of a restraining order, injunction or any other order or judgment in law or equity issued by a court of competent jurisdiction. The City or the City Attorney, on behalf of the people of the State of California, may seek injunctive relief to enjoin violations of, or to compel compliance with, the provisions of this Code or seek any other relief or remedy available at law or equity. (Amended by Ord. No. 177,103, Eff. 12/18/05.)

TAB E

L. LOGRANDE
ADMINISTRATOR

ASSOCIATE ZONING ADMINISTRATORS

PATRICIA BROWN
R. NICOLAS BROWN
SUE CHANG
ANIK CHARRON
LARRY FRIEDMAN
LOURDES GREEN
ERIC RITTER
MICHAEL S.Y. YOUNG

CITY OF LOS ANGELES
CALIFORNIA



RECEIVED APR 22 2008

ANTONIO R. VILLARAIGOSA
MAYOR

DEPARTMENT OF
CITY PLANNING
S. GAIL GOLDBERG, AICP
DIRECTOR

OFFICE OF
ZONING ADMINISTRATION
200 N. SPRING STREET, 7TH FLOOR
LOS ANGELES, CA 90012
(213) 978-1318
FAX: (213) 978-1334
www.lacity.org/PLN

April 22, 2008

Steven P. Rusch (A)
Plains Exploration & Production Co.
5640 South Fairfax Avenue
Los Angeles, CA 90056

Brown PXP Properties, LLC (O)
5640 South Fairfax Avenue
Los Angeles, CA 90056

Edgar Salazar (R)
5640 South Fairfax Avenue
Los Angeles, CA 90056

CASE NO. ZA 17528(PA3)
APPROVAL OF PLANS – DETERMINATION
OF METHODS AND CONDITIONS
1349-1375 Jefferson Boulevard
South Los Angeles Planning Area
Zone : C2-1VL-O
D. M. : 120B197
C. D. : 8
CEQA : ENV 2008-0823-CE
Legal Description : Lots 1-4, 7-10 and
21-24, Block G, Poole and James Tract

Pursuant to Section 13.01 of the Los Angeles Municipal Code, I hereby APPROVE:

methods and conditions controlling drilling and production operations for the use of the Jefferson drill site, located in Oil Drilling District No. 124, to re-drill one Class "A" oil well identified as J-30RD2 to be bottomed within Urbanized Oil Drilling District No. U-135,

upon the following additional terms and conditions:

1. The existing and proposed well corridors shall be in substantial conformance with plot plans submitted and attached to the file identified as "Exhibit No. A" dated February 5, 2008.
2. All terms and conditions specified under extant ZA Case No. 17528 shall be strictly complied with, except for Condition No. 9 of said grant which is hereby modified to address the period of time necessary to re-drill the subject oil wells as follows:
9. That as further amplification of Condition No. 49 of Section 13.01-F of the Municipal Code, except for actual drilling and production operations, which may be conducted 24 hours a day, seven days a week, no work shall be conducted on the property between the hours of 7 p.m. of one day and 7 a.m. of the following day or on Sundays. While actual drilling operations are being conducted between the hours of 7 p.m. of and 7 a.m., the applicant shall operate its facility in "Quiet Mode." "Quiet Mode" shall mean that where

ZA 17528-PA4



AN EQUAL EMPLOYMENT OPPORTUNITY – AFFIRMATIVE ACTION EMPLOYER



possible, operation components shall be covered with acoustical shields/material, that all audible backup alarms shall be disabled and replaced with a spotter for safety purposes; operation of the cellar pump shall cease; the applicant's employees and contractors shall be prohibited from yelling, and the Derrick Man and Driller shall communicate by walkie-talkie only when the Derrick Man is on the derrick; no horns shall be used to signal for time for connection or to summon crew (except that a horn may be used for emergency purposes only). The applicant shall conduct onsite meetings to inform all personnel of quiet mode operations.

In case of an emergency, all restrictions on the hours of operations shall be suspended for as long as is necessary to resolve the emergent situation, and for no longer.

Notwithstanding the foregoing, during the period necessary to set up and move the drilling rig off the premises, and to conduct drilling or re-drilling operations as herein authorized, heavy ("permitted" oversize/overweight load) truck deliveries shall be permitted from 7 a.m. to 9:30 p.m., on week days, none during weekends and holidays. Deliveries shall be made by approaching the facility off of Jefferson Boulevard, entering the facility on Budlong Avenue, exiting the facility on Van Buren Place, and proceeding back onto Jefferson Boulevard or visa versa, entering the facility on Van Buren Place, exiting the facility on Budlong Avenue, and proceeding back onto Jefferson Boulevard. Delivery trucks are to be staged off-site so as to reduce the time that trucks need to wait to enter the facility. If there is not sufficient room within the interior of the facility to accommodate a given heavy delivery truck, the applicant shall not call for the delivery of such heavy truck unless and until another heavy delivery truck parked within the facility is scheduled to leave the facility within 15 minutes. The maximum number of heavy truck deliveries allowed for moving the drilling rig on and off the premises shall not exceed 20 loads per day for a period of four days. Except for the four days required to move the drilling rig on and off the premises, the number of "permitted" truck deliveries per day (week days only, none on weekends and holidays) shall be limited to a maximum of ten. The number of "non-permitted" truck deliveries per day (weekends and holidays only) shall be limited to a maximum of five.

The applicant shall give all abutting property owners written notice (in both English and Spanish), served by mail at least seven days prior to the dates when heavy truck traffic will commence related to moving the rig in for the drilling or re-drilling of wells. Further, to reduce congestion to the residential neighborhoods abutting the drillsite, the applicant shall employ flag men during periods of heavy truck traffic and the applicant's employees and contractors shall be prohibited from parking on Budlong Avenue or Van Buren Place during the period when the facility is being prepared and/or utilized for drilling and re-drilling purposes.

3. The applicant shall install the following sound mitigation systems and implement administrative noise controls as follows:

- a. Erect a 30-foot high blanket sound wall on three sides of the drilling rig at the Jefferson drilling site (west, north and east), with the layout and wall lengths determined after the drilling rig and equipment positioning has been established. Install the sound wall as close as possible to the drilling rig and associated equipment with no gaps or openings in the walls. The sound wall material should have a minimum STC rating of 25. Sound wall gates shall be installed with the same sound loss rating as the wall material and the gates shall be closed at all times except for material delivery or pick up. The sound wall shall not be maintained for more than 120 continuous days. Should unforeseeable mechanical problems warrant the maintenance of the sound wall for a period exceeding the 120 continuous days, the applicant shall notify the Zoning Administrator and Council Office, and inform the owners and occupants of surrounding property of the reasons for and estimated duration of the delay in the dismantlement of the wall.
 - b. Deleted by action dated May 14, 2007 (Case No. ZA 17528(PA2) -
 - c. To reduce sound from the drilling rigs sub-structure, acoustical blankets shall be hung from the exterior of the rig floor down to the ground, covering the open area of the rig sub-structure on the side of the rig facing the north property line.
 - d. The stabbing platform on the rigs derrick shall be enclosed with STC-25 rated acoustical blankets.
 - e. To mitigate the drilling rig draw works and brake noise level, sound damping acoustical material shall be installed and maintained during drilling activities.
 - f. Position all ancillary noise generation equipment away from the nearest critical receptors when feasible and install temporary sound enclosures, where possible on all noise generation equipment and operations.
 - g. Install vibration isolation pads on shaker units and provide low frequency designed sound absorption and barring panels adjacent to the shaker units.
 - h. Implement PXP "quiet mode" operation procedures including limitation of material delivery schedules and other sound mitigation requirements.
 - i. To ensure adequate sound mitigation has been installed, and to identify any unusual or unique noise problems, sound level measurement and testing shall be complete as the rig starts up operations. To verify and document sound level compliance, continuous sound level measurement and monitoring may be considered during all drilling activity.
4. Drilling operations as described in Condition No. 2 above may be conducted seven days per week on a 24-hour basis, including any nationally recognized holiday. Drilling operations shall be completed within 36 months from the effective date of this determination.

5. The applicant shall permanently post at all of the site's entry gates a direct telephone number to the supervisor of the site at that time for residents to call and report any ongoing problem. A call log shall be maintained including date and time of call and subject, and date and time of response and action. Said log shall be made available at the request of the Zoning Administrator.
6. The site and its adjoining sidewalks and parkways shall be kept free and clear of debris at all times.
7. All graffiti on the site shall be removed or painted over to match the color of the surface to which it is applied within 24 hours of its occurrence.
8. The authorized use shall be conducted at all times with due regard for the character of the surrounding district, and the right is reserved to the Zoning Administrator to impose additional corrective conditions, if, in the opinion of the Zoning Administrator, such conditions are proven necessary for the protection of persons in the neighborhood or occupants of adjacent property.
9. All lighting on the site shall be shielded and directed onto the site and no floodlighting shall be located so as to be seen directly from any adjacent residential area.
10. At any time during the period of validity of this grant, should documented evidence be submitted showing continued violation of any condition of this grant, resulting in an unreasonable level of disruption or interference with the peaceful enjoyment of the adjoining and neighboring properties, the Zoning Administrator reserves the right to require the applicant to file for a plan approval application together with associated fees pursuant to LAMC Section 19.01-C (Plan Approval 12.24-M \$1,898 or as in effect at the time of filing), the purpose of which will be to hold a public hearing to review the applicant's compliance with and the effectiveness of these conditions. The applicant shall prepare a radius map and cause a notification to be mailed to all owners and occupants of properties within a 500-foot radius of the property, the Council Office, and the Los Angeles Police Department corresponding Division. The applicant shall also submit a summary and any supporting documentation of how compliance with each condition of this grant has been attained. Upon this review the Zoning Administrator may modify, add or delete conditions, and reserves the right to conduct this public hearing for nuisance abatement/revocation purposes.

TRANSFERABILITY

This authorization runs with the land. In the event the property is to be sold, leased, rented or occupied by any person or corporation other than yourself, it is incumbent upon you to advise them regarding the conditions of this grant.

VIOLATIONS OF THESE CONDITIONS, A MISDEMEANOR

Section 12.29 of the Los Angeles Municipal Code provides:

"A variance, conditional use, adjustment, public benefit or other quasi-judicial approval, or any conditional approval granted by the Director, pursuant to the

authority of this chapter shall become effective upon utilization of any portion of the privilege, and the owner and applicant shall immediately comply with its Conditions. The violation of any valid Condition imposed by the Director, Zoning Administrator, Area Planning Commission, City Planning Commission or City Council in connection with the granting of any action taken pursuant to the authority of this chapter, shall constitute a violation of this chapter and shall be subject to the same penalties as any other violation of this Code."

Every violation of this determination is punishable as a misdemeanor and shall be punishable by a fine of not more than \$1,000 or by imprisonment in the county jail for a period of not more than six months, or by both such fine and imprisonment.

APPEAL PERIOD - EFFECTIVE DATE

The applicant's attention is called to the fact that this grant is not a permit or license and that any permits and licenses required by law must be obtained from the proper public agency. Furthermore, if any Condition of this grant is violated or if the same be not complied with, then the applicant or his successor in interest may be prosecuted for violating these Conditions the same as for any violation of the requirements contained in the Municipal Code. The Zoning Administrator's determination in this matter will become effective after MAY 7, 2008, unless an appeal therefrom is filed with the City Planning Department. It is strongly advised that appeals be filed early during the appeal period and in person so that imperfections/incompleteness may be corrected before the appeal period expires. Any appeal must be filed on the prescribed forms, accompanied by the required fee, a copy of the Zoning Administrator's action, and received and receipted at a public office of the Department of City Planning on or before the above date or the appeal will not be accepted. **Forms are available on-line at www.lacity.org/pln**. Public offices are located at:

Figueroa Plaza
201 North Figueroa Street,
4th Floor
Los Angeles, CA 90012
(213) 482-7077

Marvin Braude San Fernando
Valley Constituent Service Center
6262 Van Nuys Boulevard, Room 251
Van Nuys, CA 91401
(818) 374-5050

If you seek judicial review of any decision of the City pursuant to California Code of Civil Procedure Section 1094.5, the petition for writ of mandate pursuant to that section must be filed no later than the 90th day following the date on which the City's decision became final pursuant to California Code of Civil Procedure Section 1094.6. There may be other time limits which also affect your ability to seek judicial review.

INDEMNIFICATION

The applicant shall defend, indemnify and hold harmless the City, its agents, officers, or employees from any claim, action, or proceeding against the City or its agents, officers, or employees to attack, set aside, void or annul this approval which action is brought within the applicable limitation period. The City shall promptly notify the applicant of any claim, action, or proceeding and the City shall cooperate fully in the defense. If the City fails to

promptly notify the applicant of any claim action or proceeding, or if the city fails to cooperate fully in the defense, the applicant shall not thereafter be responsible to defend, indemnify, or hold harmless the City.

NOTICE

The applicant is further advised that all subsequent contact with this office regarding this determination must be with the Zoning Administrator who acted on the case. This would include clarification, verification of condition compliance and plans or building permit applications, etc., and shall be accomplished **BY APPOINTMENT ONLY**, in order to assure that you receive service with a minimum amount of waiting. You should advise any consultant representing you of this requirement as well.

FINDINGS OF FACT

After thorough consideration of the statements contained in the application, the plans submitted therewith, the report of the Zoning Analyst thereon, the statements made at the public hearing on March 5, 2007, all of which are by reference made a part hereof, as well as knowledge of the property and surrounding district, I find as follows:

1. The site, known as the Jefferson Drill Site, part of the Las Cienegas oil field, is located on a level, 1.86 acres, rectangular-shaped property, comprised of twelve record lots located on the north side of Jefferson Boulevard, between Van Buren Place to the west, and Budlong Avenue to the east. The Drill Site is classified in the C2-1VL-O, R2-1-O, and RD1.5-1-O Zones, and within Urbanized Oil Drilling District No. U124 as established by Ordinance No. 129,760 established in 1965. The nearest residential uses are located to the north of the site, and on the west and east sides of Van Buren Place and Budlong Avenue, respectively.

A review of the past record and information attached to the file indicates that oil drilling and oil production have occurred on the site since its first been authorized to operate at this location on April 29, 1965 under ZA Case No. 17528. Subsequent cases have also regulated oil production on the property, mainly addressing the need for occasional drilling or re-drilling of new or existing wells. The last such submittal was approved by the Zoning Administrator on May 14, 2007 to permit the re-drilling of five class "A" oil wells. Several amendments to this action were subsequently issued by Letters of Correction dated June 1, 2007, and August 23, 2007, and Letters of Clarification dated December 20, 2007, and March 21, 2008.

As previously disclosed at the public hearing on the last application, only three of the five wells authorized in May of 2007 were expected to be drilled in 2007. The applicant originally anticipated that it would drill the remaining two wells in early January 2008. Given new information received as a result of ongoing geological analysis, the applicant has determined that it needs to re-drill 3 wells in 2008. Since only two wells have been approved, the applicant proposes, with the instant review, the re-drilling of one Class "A" oil well identified as J-30RD2 of the Jefferson drill site to be bottomed within Urbanized Oil Drilling District No. U-135.

Urbanized Oil Drilling District No. U-135 was established by Ordinance No. 131,452, which authorized the Zoning Administrator to permit drilling and production from a maximum of six (6) wells. Currently, Well No. J-30RD is the only active producer bottomed in U-135. There is also one (1) active injection well bottomed in U-135 in addition to one (1) idle producer and one (1) idle injector, for a total of four (4) wells bottomed in U-135. Due to mechanical problems with the existing well, the applicant hereby requests authority to re-drill Well No. J-30RD as Well No. J-30RD2. With this action the total number of wells bottomed in U-135 will remain unchanged (four wells).

2. The most frequent purpose of the re-drilling is to remedy down hole problems that have developed with the wells, more specifically when the wells are almost dry. Once they are dry, the operator of the site immediately begins re-drilling the wells at different subsurface sites, the surface location remaining the same. The re-drilling allows the operator to tap into other areas a few miles below the surface that will yield more oil. Without such re-drilling the wells are not fully operational. It is for this purpose that the subject request has been filed seeking terms and conditions controlling drilling and production operations.
3. At the public hearing held in March 2007 on the previous application (Case No. ZA-17528(PA2)), a representative of the Council District Office reported that no complaints had been received from constituents living in the immediate vicinity of the site. Since then, this Zoning Administrator has not been made aware of any current concern, and the public hearing for this application was consequently waived, under the assumption that the current conditions of operation at this location are effective in reasonably mitigating any possible impact of the use of the site for drilling operations. The same conditions are therefore applied to this application, consistent with the current mode of operation of the site.

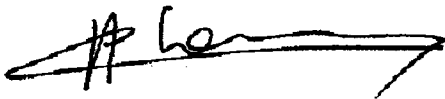
The applicant has been drilling on the site since the mid 1960s in accordance with numerous prior Zoning Administrator approvals. The proposed re-drilling will be conducted in compliance with those approvals and any Methods and Conditions which may be applicable, including those placed on the applicant by this letter. It is a normal and necessary function of petroleum operations to re-drill from established drill sites not only to find and extract additional oil reserves or to correct subsidence problems, but to correct extraction problems which may occur from time to time. As such, it can be found that the requested re-drilling of the involved wells, and modification of conditions, as approved, is appropriate.

4. The proposed re-drill program will require approximately 15 to 21 days per well to complete, working 24 hours per day and seven days per week. The applicant has 36 months to utilize this grant. All re-drilling operations will be conducted on the controlled drill site. To maintain reasonable noise levels, sound proofed state of the art drilling equipment and technology will be utilized. In addition, the applicant will attempt to minimize the amount of time spent running pipe into and out of the well (Tripping), as tripping is usually the noisiest part of the re-drilling operation, this will reduce the amount of noise generated by the proposed operation, in addition to the noise mitigation measures made part of the conditions of approval of the instant grant.

5. Upon completion of the re-drilling operations, production activities will be resumed under the terms and conditions of previous grants. In a time where dependence on foreign oil comes at an increasingly higher social, economical and political cost, it can be found that this approval, by encouraging and facilitating local oil production, under strict controls as to the possible impacts it may have on the immediate vicinity of the production site, will be of direct benefit to the public as a whole.

ADDITIONAL MANDATORY FINDINGS

6. The National Flood Insurance Program rate maps, which are a part of the Flood Hazard Management Specific Plan adopted by the City Council by Ordinance No. 172,081, have been reviewed and it has been determined that this project is located in Zone B, areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 foot or where the contributing drainage area is less than 1 square mile; or areas protected by levees from the base flood.
7. On March 3, 2008, the project was issued a Notice of Exemption (Article III, Section 3, City CEQA Guidelines), log reference ENV 2008-0823-CE, for a Categorical Exemption, Class 5, Category 23, City CEQA Guidelines, Article VII, Section 1, State EIR Guidelines, Section 15100. I hereby adopt that action.

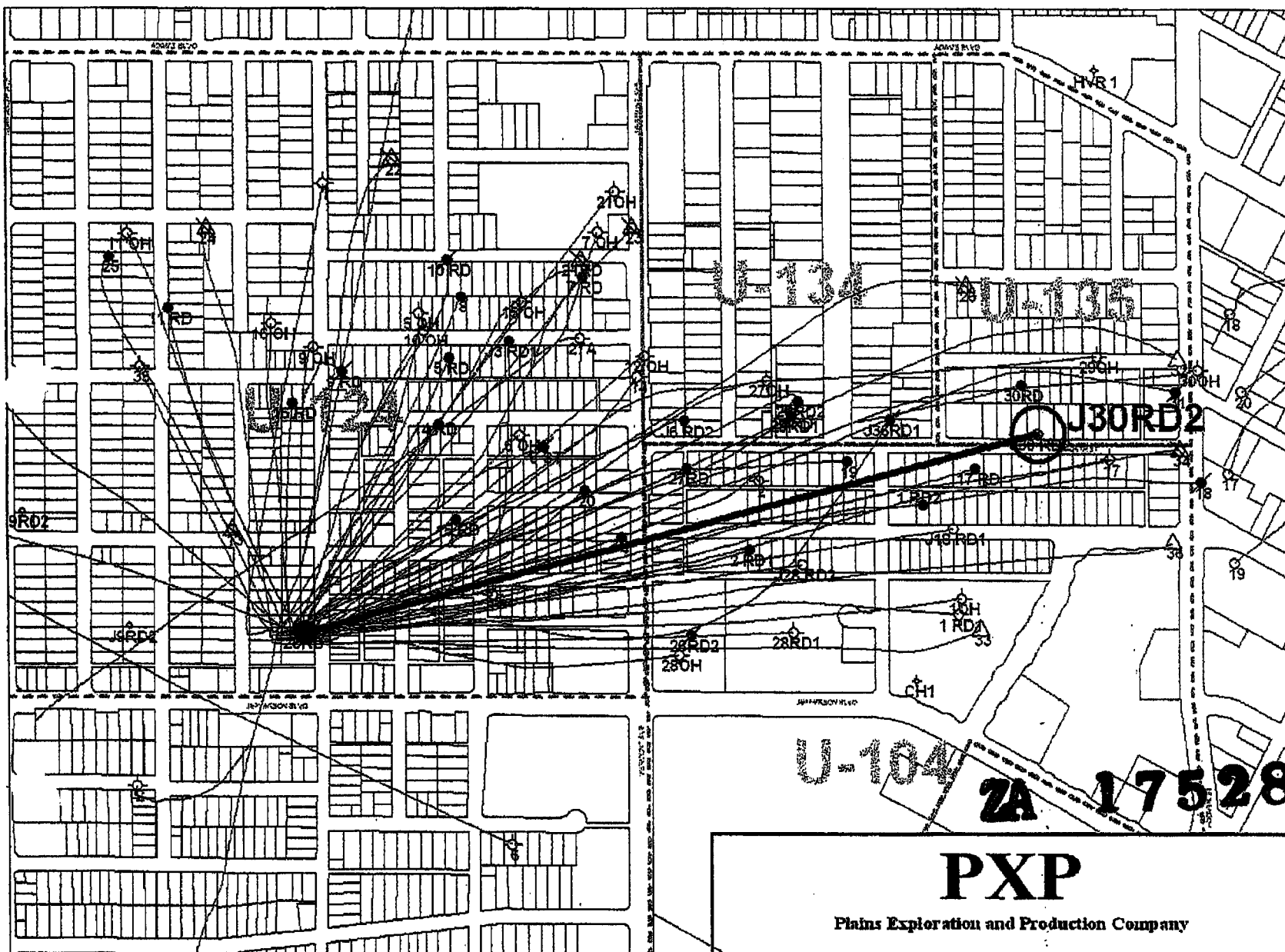


ANIK CHARRON
Associate Zoning Administrator
Direct Telephone No. (213) 978-1307

AC:lmc

cc: Councilmember Bernard C. Parks
Eighth District
Adjoining Property Owners
County Assessor
Department of Water and Power
Fire Department, Bureau of Fire
Prevention and Public Safety
Office of Administration & Research Services
STOP 130

EXHIBIT "A"



- surface location
- well path
- bottomhole location

1 inch = 600 feet

400 0 400 ft



PXP
Plains Exploration and Production Company

Las Cienegas Field
Jefferson Drillsite
Proposed Well J30RD2
(proposed well in red)

Author:
Rich Keogh
Sec 1&2 - T2S/R14W
Los Angeles Co., CA

Scale:
1" = 600 feet

Date:
5 February, 2008

LEGEND

Deviated well - Bottom hole location

Well Status

- ACT
- △ ACTINJ
- ⊕ P&A
- ⊗ SI
- △ SINJ
- APP. PENDING

TAB F

CITY OF LOS ANGELES MUNICIPAL CODE

§ 13.01 – “O” OIL DRILLING DISTRICTS.

E. Standard Conditions:

2. Urbanized Areas – Each oil drilling district established in an urbanized area shall be subject to the following conditions:

(a) Each district shall be not less than 40 acres in area, including all streets, ways and alleys within the boundaries thereof.

(b) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) Not more than one controlled drill site shall be permitted for each 40 acres in any district and that site shall not be larger than two acres when used to develop a district approximating the minimum size; provided, however, that where the site is to be used for the development of larger oil drilling districts or where the Zoning Administrator requires that more than one oil drilling district be developed from one controlled drilling site, the site may be increased, at the discretion of the Zoning Administrator when concurred in by the Board of Fire Commissioners, by not more than two acres for each 40 acres included in the district or districts.

(c) (Amended by Ord. No. 147,651, Eff. 10/11/75.) The number of oil wells Class A which may be drilled and operated from any controlled drilling site may not exceed one well to each five acres in the district or districts to be explored from said site.

Notwithstanding the above, should the City Council determine that an urbanized oil drilling district contains more than one producing zone, the City Council may then authorize, by ordinance, the drilling of additional oil wells Class A, not to exceed one well per five acres for each identified producing zone, and specify the maximum number of wells to be drilled as the result of such authorization.

(d) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) Each applicant, requesting a determination by the Zoning Administrator prescribing the conditions controlling drilling and production operations, as provided in Subsection H of this section, must have proprietary or contractual authority to drill for oil under the surface of at least 75 percent of the property in the district to be explored.

(e) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) Each applicant or his or her successor in interest shall, within one year from the date the written determination is made by a Zoning Administrator prescribing the conditions controlling drilling and production operations as provided in Subsection H of this section, execute an offer in writing giving to each record owner of property located in the oil drilling district who has not joined in the lease or other authorization to drill the right to share in the proceeds of production from wells bottomed in the district, upon the same basis as those property owners who have, by lease or other legal consent, agreed to the drilling for and production of oil, gas or other hydrocarbon substances from the subsurface of the district. The offer hereby required must remain open for acceptance for a period of five years after the date the written determination is made by a Zoning Administrator. During the period the offer is in effect, the applicant, or his or her successor in interest, shall impound all royalties to which the owners or any of them may become entitled in a bank or trust company in the State of California, with proper provisions for payment to the record owners of property in the district who had not signed the lease at the time the written provisions were made by a Zoning Administrator, but who accepts the offer in writing within the five-year period. Any such royalties remaining in any bank or trust company at the time the offer expires which are not

due or payable as provided above shall be paid pro-rata to those owners who, at the time of the expiration, are otherwise entitled to share in the proceeds of the production.

(f) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) The entire controlled drilling site shall be adequately landscaped, except for those portions occupied by any required structure, appurtenance or driveway, and all landscaping shall be maintained in good condition at all times. Plans showing the type and extent of the landscaping shall be first submitted to and approved by the Zoning Administrator.

(g) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) Each applicant, requesting a determination by a Zoning Administrator prescribing the conditions controlling drilling and production operations, as provided in Subsection H of this section, shall post in the Office of Zoning Administration a satisfactory corporate surety bond (to be approved by the City Attorney and duplicates to be furnished to him or her) in the sum of \$5,000 in favor of the City of Los Angeles, conditioned upon the performance by the applicant of all of the conditions, provisions, restrictions and requirements of this section, and all additional conditions, restrictions or requirements determined and prescribed by a Zoning Administrator. No extension of time that may be granted by a Zoning Administrator or any change or specifications or requirements that may be approved or required by him or her or by any other officer or department of the City or any other alteration, modification of waiver affecting any of the obligations of the grantee made by any City authority or by any other power or authority whatsoever shall be deemed to exonerate either the grantee or the surety on any bond posted pursuant to this section.

(h) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) If a Zoning Administrator determines, after first receiving a report and recommendation from the Director of the Office of Administrative and Research Services, that oil drilling and production activities within the district have caused or may cause subsidence in the elevation of the ground within the district or in the immediate vicinity, then after consulting with recognized experts in connection with that problem and with those producing hydrocarbons from the affected area, he or she shall have the authority to require the involved oil producer or producers to take corrective action, including re-pressurizing the oil producing structure or cessation of oil drilling and production.

(i) (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) A Zoning Administrator may impose additional conditions or require corrective measures to be taken if he or she finds, after actual observation or experience with drilling one or more of the wells in the district, that additional conditions are necessary to afford greater protection to surrounding property.

F. Additional Conditions. In addition to the standard conditions applying to oil drilling districts, the Council, by ordinance, or the Zoning Administrator may impose other conditions in each district as deemed necessary and proper. Where these conditions are imposed by ordinance, they may be subsequently modified or deleted in the following manner:

(a) where the condition relates to the location of a drill site within a district, by amending the ordinance, only after the submission of an application, the payment of fees, notice, hearing and procedure identical to that required by this article for the establishment of an oil drilling district; and

(b) where the condition does not relate to the location of a drill site, by amending the ordinance, without the necessity of fees, notice or hearing.

In its report to the Council relative to the establishment of a district, the City Planning Commission may recommend conditions for consideration. Some of these additional conditions, which may be imposed in the ordinance establishing the districts or by the Zoning Administrator in determining the drilling site requirements, and which may be applied by reference, are as follows: (Para. Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.)

1. That all pumping units established in said district shall be installed in pits so that no parts thereof will be above the surface of the ground.

2. That all oil produced in said district shall be carried away by pipe lines or, if stored in said district, shall be stored in underground tanks so constructed that no portion thereof will be above the surface of the ground.

3. (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) That the operator of any well or wells in the district shall post in the Office of Zoning Administration a \$5,000 corporate surety bond conditioned upon the faithful performance of all provisions of this article and any conditions prescribed by a Zoning Administrator. No extension of time that may be granted by a Zoning Administrator, or change of specifications or requirements that may be approved or required by him or her or by any other officer or department of the City, or other alteration, modification or waiver affecting any of the obligations of the grantee made by any City authority shall be deemed to exonerate either the grantee or the surety on any bond posted as required in this article.

4. That the operators shall remove the derrick from each well within thirty (30) days after the drilling of said well has been completed, and thereafter, when necessary, such completed wells shall be serviced by portable derricks.

5. (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) That the drilling site shall be fenced or landscaped as prescribed by the Zoning Administrator.

6. (None)

7. That, except in case of emergency, no materials, equipment, tools or pipe used for either drilling or production operations shall be delivered to or removed from the drilling site, except between the hours of 8:00 A. M. and 8:00 P. M. of any day.

8. That adequate fire fighting apparatus and supplies, approved by the Fire Department, shall be maintained on the drilling site at all times during drilling and production operations.

9. That no refining process or any process for the extraction of products from natural gas shall be carried on at a drilling site.

10. (None)

11. (None)

12. (None)

13. That no more than one well shall be bottomed in each five (5) acres of the drilling district.

14. That no new oil wells shall be spudded in after the President of the United States, or other proper authority, has declared that a state of war no longer exists.

15. (None)

16. (None)

17. (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) That any person requesting a determination by the Zoning Administrator prescribing the conditions under which oil drilling and production operations shall be conducted as provided in Subsection H, shall agree in writing on behalf of him or herself and his or her successors or assigns, to be bound by all of the terms and conditions of this article and any conditions prescribed by written determination by the Zoning Administrator; provided, however, that the agreement in writing shall not be construed to prevent the applicant or his or her successors or assigns from applying at any time for amendments pursuant to this Article or to the conditions prescribed by the Zoning Administrator, or from applying for the creation of a new district or an extension of time for drilling or production operations.

18. That all production equipment used shall be so constructed and operated that no noise, vibration, dust, odor or other harmful or annoying substances or effect which can be eliminated or diminished by the use of greater care shall ever be permitted to result from production operations carried on at any drilling site or from anything incident thereto to the injury or annoyance of persons living in the vicinity; nor shall the site or structures thereon be permitted to become dilapidated, unsightly or unsafe. Proven technological improvements in methods of production shall be adopted as they, from time to time, become available if capable of reducing factors of nuisance or annoyance.

19. Wells which are placed upon the pump shall be pumped by electricity with the most modern and latest type of pumping units of a height of not more than sixteen (16) feet. All permanent equipment shall be painted and kept in neat condition. All production operations shall be as free from noise as possible with modern oil operations.

20. All drilling equipment shall be removed from the premises immediately after drilling is completed, sump holes filled, and derricks removed within sixty (60) days after the completion of the well.

21. That, subject to the approval of the Board of Fire Commissioners, the operators shall properly screen from view all equipment used in connection with the flowing or pumping of wells.

22. Upon the completion of the drilling of a well the premises shall be placed in a clean condition and shall be landscaped with planting of shrubbery so as to screen from public view as far as possible, the tanks and other permanent equipment, such landscaping and shrubbery to be kept in good condition.

23. (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) That not more than two wells may be drilled in each city block of the drilling district and bottomed under that block. However, at the discretion of the Zoning Administrator, surface operations for additional wells may be permitted in each of the blocks where each additional well is to be directionally drilled and bottomed under an adjacent block now or hereafter established in an oil drilling district in lieu of a well drilled on the adjacent block and under a spacing program which will result in not exceeding two wells bottomed under each block.

24. That not more than one (1) well shall be drilled in each city block of the drilling district; provided, however, that a second well may be drilled in that block bounded by "L", Gulf Avenue, Denni Street and Wilmington Boulevard, only in the event said second well be directionally drilled or whipstocked so that the bottom of the hole will be bottomed under the (Gulf Avenue School property located in the block bounded by "L" Street, Roman Avenue, Denni Street and Gulf Avenue, and in lieu of a well which might otherwise be permitted to be drilled in said last mentioned block.

25. That not more than one (1) well may be drilled in each city block of the drilling district.

26. That all power operations other than drilling in said district shall at all times be carried on only by means of electrical power, which power shall not be generated on the drilling site.

27. (None)

28. (None)

29. That not more than two (2) wells may be drilled in each city block of the drilling district; provided, however, that two (2) additional wells may be drilled in each of the following described blocks, (a) the block bounded by Q Street, Lakme Avenue, Sandison Street and Broad Avenue and (b) the block bounded by Sandison Street, Lakme Avenue, Broad Avenue and the southerly boundary of Tract No. 1934, but only if such additional wells are directionally drilled or whipstocked so that they will be bottomed under the Hancock-Banning High school property, located in the block bounded by Delores Street, Broad Avenue, Pacific Coast Highway and Avalon Boulevard, in lieu of the four (4) wells which might otherwise be permitted to be drilled in the last mentioned block.

30. (None)

31. Not more than four (4) controlled drilling sites shall be permitted in this district, and such sites shall not be larger than two (2) acres.

32. The number of wells which may be drilled to any oil sand from the controlled drilling site shall not exceed one (1) well to each five (5) acres in the district, but in no event shall there be more than one (1) well to each two and one-half (2 1/2) acres.

33. (Amended by Ord. No. 173,268, Eff. 7/1/00, Oper. 7/1/00.) That drilling operations shall be commenced within 90 days from the effective date the written determination is made by the Zoning Administrator or Area Planning Commission, or within any additional period as the Zoning Administrator may, for good cause, allow and thereafter shall be prosecuted diligently to completion or else abandoned strictly as required by law and the premises restored to their original condition as nearly as practicable as can be done. If a producing well is not secured within eight months, the well shall be abandoned and the premises restored to its original condition, as nearly as practicable as can be done. The Zoning Administrator, for good cause, shall allow additional time for the completion of the well.

34. That an internal combustion engine or electrical equipment may be used in the drilling or pumping operations of the well, and if an internal combustion engine is used, that mufflers be installed on the mud pumps and engine so as to reduce noise to a minimum, all of said installations to be done in a manner satisfactory to the Fire Department.

35. (None)

36. That not more than two (2) production tanks shall be installed for each producing well, neither one of which shall have a rated capacity in excess of one thousand (1,000) barrels; provided, however, that if in the opinion of the Administrator it is necessary in order to provide for the maximum safety of operations or to decrease the number of individual production tank settings on any property, the Administrator may increase the number of such production tanks to not more than three (3), having a greater capacity not to exceed two thousand (2,000) barrels each. The Administrator shall permit such wash tanks or heating facilities as may appear necessary to ship or remove production from the premises. The plans for said tank or tanks, including the plot plan showing the location thereof on the property, shall be submitted to and approved in writing by the Administrator before said tank or tanks and appurtenances are located on the premises; and that said tank or tanks and appurtenances shall be kept painted and maintained in good condition.

37. All waste substances such as drilling muds, oil, brine or acids produced or used in connection with oil drilling operations or oil production shall be retained in water-tight receptors from which they may be piped or hauled for terminal disposal in a dumping area specifically approved for such disposal by the Los Angeles Regional Water Pollution Control Board No. 4.

38. Any wells drilled shall be cased tight to bedrock or effective means satisfactory to the Department of Water and Power used to prevent vertical movement of ground water.

39. The applicant shall provide the Department of Water and Power with a precise plot plan of the drilling plant and roads leading thereto, and to make such safeguards as the Department deems necessary to assure the safety of the existing 50" water main which crosses the district involved.

40. The Department of Water and Power of the City of Los Angeles shall be permitted to review and inspect methods used in the drilling and producing operations and in the disposal of waste, and shall have the right to require changes necessary for the full protection of the public water supply.

41. (None)

42. That the number of wells which may be drilled to any oil sand shall not exceed one (1) well to each five (5) acres in the district, but in no event shall there be more than one (1) well to each two and one-half acres.

43. That drilling, pumping and other power operations shall at all times be carried on only by electrical power and that such power shall not be generated on the controlled drilling site or in the district.

44. That an internal combustion engine or steam-driven equipment may be used in the drilling or pumping operations of the well, and, if an internal combustion engine or steam-driven equipment is used, that mufflers be installed on the mudpumps and engine; and that the exhaust from the steam-driven machinery be expelled into one of the production tanks, if such tanks are permitted, so as to reduce noise to a minimum, all of said installations to be found in a manner satisfactory to the Fire Department.

45. That drilling operations shall be carried on or conducted in connection with only one well at a time in any one such district, and such well shall be brought in or abandoned before operations for the drilling

of another well are commenced; provided, however, that the Administrator may permit the drilling of more than one well at a time after the discovery well has been brought in.

46. That all oil drilling and production operations shall be conducted in such a manner as to eliminate, as far as practicable, dust, noise, vibration or noxious odors, and shall be in accordance with the best accepted practices incident to drilling for and production of oil, gas and other hydrocarbon substances. Proven technological improvements in drilling and production methods shall be adopted as they may become, from time to time, available, if capable of reducing factors of nuisance and annoyance.

47. That all parts of the derrick above the derrick floor not reasonably necessary for ingress and egress including the elevated portion thereof used as a hoist, shall be enclosed with fire-resistive soundproofing material approved by the Fire Department, and the same shall be painted or stained so as to render the appearance of said derrick as unobtrusive as practicable.

48. That all tools, pipe and other equipment used in connection with any drilling or production operations shall be screened from view, and all drilling operations shall be conducted or carried on behind a solid fence, which shall be maintained in good condition at all times and be painted or stained so as to render such fence as unobtrusive as practicable.

49. That no materials, equipment, tools or pipe used for either drilling or production operations shall be delivered to or removed from the controlled drilling site except between the hours of 8:00 o'clock a. m. and 6:00 o'clock p. m. , on any day, except in case of emergency incident to unforeseen drilling or production operations, and then only when permission in writing has been previously obtained from the Administrator.

50. That no earthen sumps shall be used.

51. That within sixty (60) days after the drilling of each well has been completed, and said well placed on production, or abandoned, the derrick, all boilers and all other drilling equipment shall be entirely removed from the premises unless such derrick and appurtenant equipment is to be used within a reasonable time limit determined by the Administrator for the drilling of another well on the same controlled drilling site.

52. That no oil, gas or other hydrocarbon substances may be produced from any well hereby permitted unless all equipment necessarily incident to such production is completely enclosed within a building, the plans for said building to be approved by the Department of Building and Safety and the Fire Department. This building shall be of a permanent type, of attractive design and constructed in a manner that will eliminate as far as practicable, dust, noise, noxious odors and vibrations or other conditions which are offensive to the senses, and shall be equipped with such devices as are necessary to eliminate the objectionable features mentioned above. The architectural treatment of the exterior of such building shall also be subject to the approval of the Administrator.

53. That no oil, gas or other hydrocarbon substances may be produced from any well hereby permitted where same is located within or immediately adjoining subdivided areas where ten (10) percent of the lots or subdivided parcels of ground, within one-half (1/2) mile radius thereof, are improved with residential structures, unless all equipment necessarily incidental to such production is countersunk below the natural surface of the ground and such installation and equipment shall be made in accordance with Fire Department requirements.

54. That there shall be no tanks or other facilities for the storage of oil erected or maintained on the premises and that all oil products shall be transported from the drilling site by means of an underground pipe line connected directly with the production pump without venting products to the atmospheric pressure at the production site.

55. That not more than two production tanks shall be installed on said drilling site, neither one of which shall have a rated capacity in excess of one thousand (1000) barrels; that the plans for said tank or tanks, including the plot plans showing the location thereof on the property, shall be submitted to and approved in writing by the Administrator before said tank or tanks and appurtenances are located on the premises, and that said tank or tanks and appurtenances shall be kept painted and maintained in good condition at all times.

56. That any production tanks shall be countersunk below the natural surface of the ground and the installation thereof shall be made in accordance with safety requirements of the Fire Department.

57. That no refinery, dehydrating or absorption plant of any kind shall be constructed, established or maintained on the premises at any time.

58. That no sign shall be constructed, erected, maintained or placed on the premises or any part thereof, except those required by law or ordinance to be displayed in connection with the drilling or maintenance of the well.

59. That suitable and adequate sanitary toilet and washing facilities shall be installed and maintained in a clean and sanitary condition at all times.

60. That any owner, lessee or permittee and their successors and assigns, must at all times be insured to the extent of one hundred thousand dollars (\$100,000) against liability in tort arising from drilling or production, or activities or operations incident thereto, conducted or carried on under or by virtue of the conditions prescribed by written determination by the Administrator as provided in Subsection H of this section. The policy of insurance issued pursuant hereto shall be subject to the approval of the City Attorney, and duplicates shall be furnished to him. Each such policy shall be conditioned or endorsed to cover such agents, lessees or representatives of the owner, lessee or permittee as may actually conduct drilling, production or incidental operations permitted by such written determination by the Administrator.

61. (None)

62. All onshore drilling and production installations or facilities shall be removed and the premises restored to their original conditions after all oil and gas wells have been abandoned, unless the City Planning Commission determines otherwise. (Amended by Ord. No. 142,081, Eff. 7/22/71.)

63. (None)

64. (None)

K. Maintenance of Drilling and Production Sites (Added by Ord. No. 119,399, Eff. 8/3/61.) Effective August 1,1962, the following regulations shall apply to existing and future oil wells within the City of Los

Angeles, including oil wells operating pursuant to any zone variance, whether by ordinance or approval of a Zoning Administrator, and all oil wells in an M3 Zone which are within 500 feet of a more restrictive zone:

1. All stationary derricks, including their floors and foundations, shall be removed within 30 days after completion or abandonment of the well (notwithstanding any other provisions of this Code to the contrary) or by September 1, 1962, whichever occurs later; and thereafter any work done on any existing well which requires the use of a derrick shall be done by a temporary or portable derrick. Such temporary or portable derricks shall be removed within 30 days after the completion of such work.
2. The motors, engines, pumps and tanks of all such oil wells shall be sealed so that no offensive or obnoxious odor or fumes can be readily detected from any point on adjacent property.
3. The well pumping equipment for such wells shall be muffled or soundproofed so that the noise emanating therefrom, measured from any point on adjacent property, is no more audible than surrounding street traffic, commercial or industrial noises measured at the same point.
4. The maximum height of the pumping units for such wells shall not exceed 15 feet above existing grade level.
5. The site of such wells shall be so landscaped, fenced or concealed that the well and all of its appurtenant apparatus is reasonably protected against public entry, observation or attraction.

In addition to any other authority vested in the Zoning Administrator by Charter and the Los Angeles Municipal Code, a Zoning Administrator may waive or modify these regulations if the drilling site is physically inaccessible to a portable derrick, or is located in a mountainous and substantially uninhabited place, or is located in an M Zone and is surrounded by vacant land or is adjacent to land used as permitted in the M Zones and if the enforcement of such regulations would be discriminatory, unreasonable or would impose a undue hardship upon oil drilling in such locations. A Zoning Administrator may also waive or modify the 16-foot height limitation where, because of the amount of liquid to be raised or the depths at which such fluids are encountered, pumping unit in excess of 16 feet in height is shown by conclusive engineering evidence to be required. (Amended by Ord. No. 125,877, Eff. 11/29/63.)

All ordinances and parts of ordinances of the City of Los Angeles in conflict herewith are hereby repealed to the extent of such conflict.

TAB G

CITY OF LOS ANGELES MUNICIPAL CODE

§ 13.18 – VIOLATION.

(Added by Ord. No. 183,145, Eff. 8/20/14.)

The violation of any condition imposed by a Zoning Administrator, Director of Planning, the Area Planning Commission, City Planning Commission or City Council in approving the site requirements, methods of operation, development plans or other actions taken pursuant to the authority contained in this article shall constitute a violation of this Code.

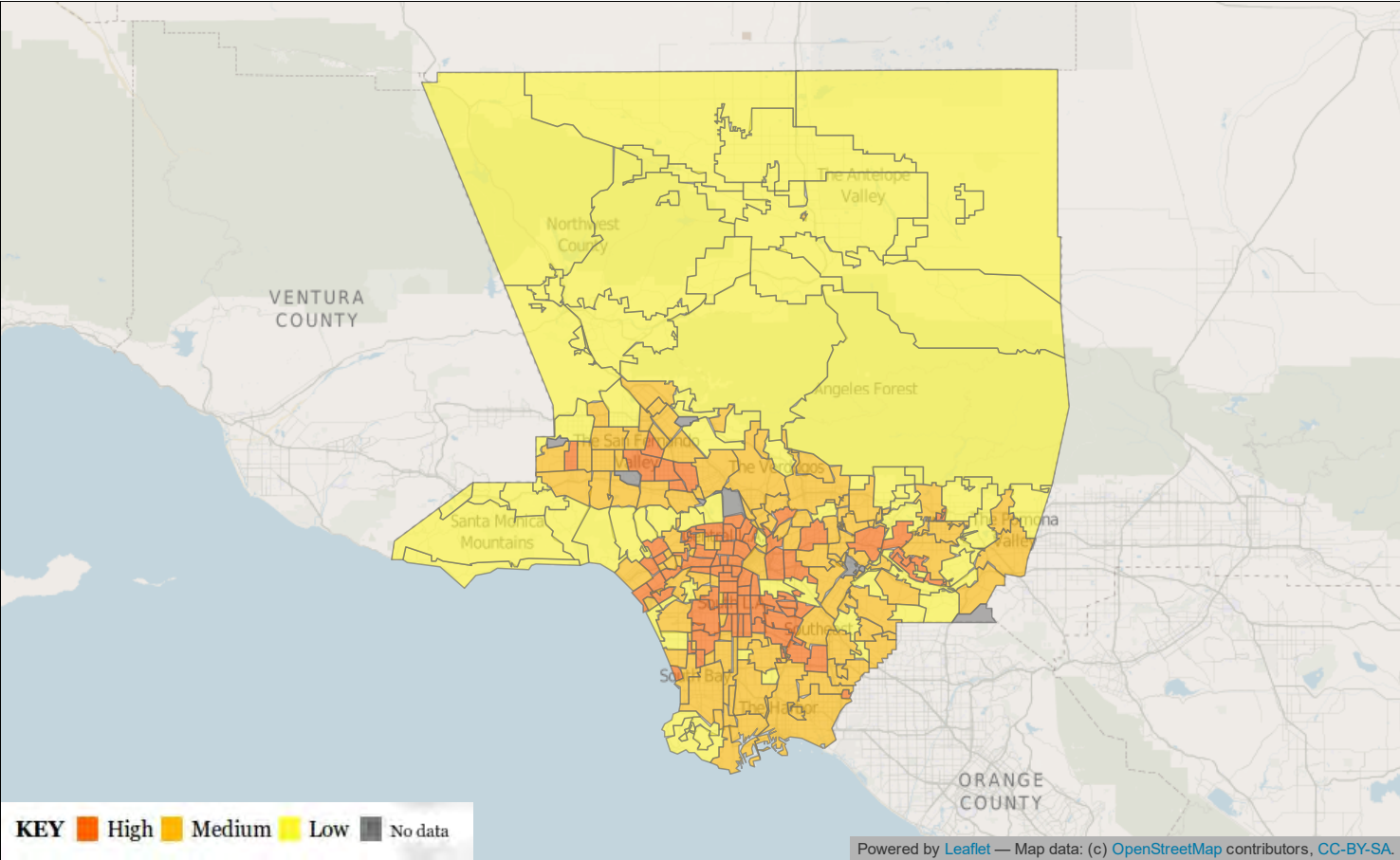
TAB H



MAPPING L.A. > RANKINGS > POPULATION

Population Density

Select one of L.A.'s 272 neighborhoods to see where it ranks



Population density measures the numbers of people per square mile.

RANK	NEIGHBORHOOD	POPULATION PER SQMI
1	Koreatown	42,611
2	Westlake	38,214
3	East Hollywood	31,095

Mapping L.A. is the Los Angeles Times' resource for crime, neighborhoods, demographics and schools in Los Angeles County.

[About this project »](#)

4	Pico-Union	25,352
5	Maywood	23,638
6	Harvard Heights	23,473
7	Hollywood	22,193
8	Walnut Park	22,028
9	Palms	21,870
10	Adams-Normandie	21,848
11	South Park	21,638
12	Lennox	21,557
13	Arlington Heights	21,423
14	Huntington Park	20,223
15	University Park	20,217
16	Cudahy	19,697
17	Historic South-Central	19,474
18	West Hollywood	18,924
19	Central-Alameda	18,760
20	Vermont-Slauson	18,577
21	Vermont Knolls	18,057
22	Panorama City	18,028
23	Vermont Square	17,798
24	Bell Gardens	17,762
25	Larchmont	17,747
26	Pico-Robertson	17,468
27	Watts	17,346
28	Westmont	17,066
29	Echo Park	16,868
30		16,863

East Los Angeles

31	Highland Park	16,835
32	Exposition Park	16,819
33	Florence-Firestone	16,805
34	East Compton	16,542
35	Jefferson Park	16,300
36	Lawndale	16,119
37	Harvard Park	16,072
38	Florence	15,661
39	Hawaiian Gardens	15,141
40	Broadway-Manchester	15,060
41	Mid-City	15,051
42	Mid-Wilshire	14,988
43	West Adams	14,686
44	Bell	14,357
45	Lynwood	14,264
46	Boyle Heights	14,229
47	Vermont Vista	14,154
48	Hawthorne	13,848
49	South San Jose Hills	13,646
50	Los Feliz	13,512
51	Cypress Park	13,478
52	Sawtelle	13,319
53	North Hollywood	13,264
54	Westwood	13,036
55	Beverly Grove	12,990
56	South Gate	12,945

57	West Puente Valley	12,855
58	Green Meadows	12,785
59	Hyde Park	12,700
60	Hermosa Beach	12,481
61	Inglewood	12,330
62	Valley Glen	12,325
63	Mar Vista	12,259
64	Canoga Park	12,240
65	West Los Angeles	12,061
66	El Monte	11,995
67	Venice	11,891
68	Citrus	11,827
69	La Puente	11,761
70	Bellflower	11,756
71	Valley Village	11,600
72	Van Nuys	11,542
73	Manchester Square	11,449
74	Del Rey	11,420
75	Paramount	11,395
76	Alhambra	11,275
77	Silver Lake	11,266
78	Baldwin Park	11,176
79	Valinda	10,748
80	Lincoln Heights	10,602
81	Reseda	10,600
82	Norwalk	10,572

83	Chinatown	10,568
84	Pacoima	10,510
85	Baldwin Hills/Crenshaw	10,446
86	Lomita	10,424
87	Rosemead	10,332
88	South Whittier	10,291
89	Vincent	10,163
90	East San Gabriel	10,157
91	Redondo Beach	10,129
92	Fairfax	10,122
93	Artesia	10,036
94	Arleta	10,034
95	North Hills	10,003
96	West Whittier-Los Nietos	9,899
97	Gardena	9,894
98	Leimert Park	9,880
99	San Fernando	9,856
100	Winnetka	9,826
101	El Sereno	9,826
102	Santa Monica	9,817
103	Charter Oak	9,816
104	Carthay	9,642
105	Mayflower Village	9,585
106	Chesterfield Square	9,571
107	San Gabriel	9,433
108	Elysian Valley	9,354
109		9,219

West Carson

110	Compton	9,199
111	Del Aire	9,132
112	Harbor City	9,127
113	Willowbrook	9,117
114	Long Beach	8,882
115	Gramercy Park	8,859
116	North El Monte	8,677
117	Manhattan Beach	8,573
118	Downey	8,566
119	Glassell Park	8,524
120	East La Mirada	8,506
121	Atwater Village	8,379
122	Temple City	8,366
123	Lakewood	8,348
124	Windsor Square	8,255
125	Sun Valley	8,048
126	San Pasqual	8,036
127	Century City	7,869
128	Monterey Park	7,823
129	Lake Balboa	7,754
130	Harbor Gateway	7,720
131	Beverlywood	7,654
132	Eagle Rock	7,644
133	Alondra Park	7,548
134	Culver City	7,475
135	Montebello	7,329

136	Pico Rivera	7,187
137	Rancho Park	7,169
138	South El Monte	7,150
139	South Pasadena	7,114
140	Montecito Heights	6,959
141	Mount Washington	6,878
142	Athens	6,829
143	Torrance	6,701
144	Covina	6,701
145	Sherman Oaks	6,687
146	San Pedro	6,640
147	Pomona	6,556
148	West Covina	6,509
149	Hancock Park	6,459
150	Toluca Lake	6,393
151	Glendale	6,368
152	Northridge	6,080
153	View Park-Windsor Hills	6,008
154	La Mirada	5,966
155	Beverly Hills	5,933
156	Avocado Heights	5,907
157	Cerritos	5,851
158	Burbank	5,785
159	Mission Hills	5,721
160	South San Gabriel	5,708
161	Marina del Rey	5,706

162	Whittier	5,688
163	Wilmington	5,636
164	Sylmar	5,579
165	La Crescenta-Montrose	5,401
166	Studio City	5,395
167	Pasadena	5,366
168	Desert View Highlands	5,160
169	Altadena	4,900
170	Downtown	4,770
171	Arcadia	4,749
172	Carson	4,676
173	East Pasadena	4,622
174	West Hills	4,551
175	Cheviot Hills	4,520
176	Hacienda Heights	4,503
177	Azusa	4,496
178	Porter Ranch	4,462
179	Encino	4,411
180	Signal Hill	4,171
181	Woodland Hills	4,040
182	Tarzana	4,038
183	La Verne	3,863
184	Westchester	3,839
185	Sunland	3,825
186	Diamond Bar	3,754
187	Rowland Heights	3,604

188	Sierra Madre	3,563
189	Playa del Rey	3,542
190	San Marino	3,428
191	Granada Hills	3,344
192	Walnut	3,329
193	West Compton	3,291
194	Duarte	3,212
195	Rancho Palos Verdes	3,084
196	Castaic	3,076
197	Hollywood Hills	3,063
198	Hollywood Hills West	3,048
199	El Segundo	2,925
200	Palos Verdes Estates	2,822
201	Lake View Terrace	2,790
202	Stevenson Ranch	2,765
203	Santa Clarita	2,745
204	Tujunga	2,649
205	Monrovia	2,643
206	Val Verde	2,588
207	Glendora	2,568
208	Agoura Hills	2,495
209	Quartz Hill	2,475
210	La Cañada Flintridge	2,369
211	Chatsworth	2,301
212	San Dimas	2,244
213	Ladera Heights	2,214
214		2,185

Rolling Hills Estates

215	Claremont	2,124
216	Brentwood	2,059
217	Santa Fe Springs	2,014
218	Commerce	1,912
219	Playa Vista	1,859
220	Lake Los Angeles	1,601
221	Elysian Park	1,538
222	Westlake Village	1,534
223	Beverly Crest	1,318
224	Calabasas	1,247
225	Bel-Air	1,207
226	Lancaster	1,180
227	Avalon	1,159
228	Ramona	1,122
229	Hidden Hills	1,100
230	Pacific Palisades	1,048
231	Shadow Hills	1,023
232	La Habra Heights	979
233	Rancho Dominguez	947
234	West San Dimas	937
235	Sun Village	917
236	Rolling Hills	893
237	Palmdale	874
238	North Whittier	797
239	Littlerock	766
240		683

Veterans Administration

241	Bradbury	658
242	Malibu	629
243	Northwest Palmdale	540
244	Topanga	386
245	Green Valley	290
246	Elizabeth Lake	219
247	Lopez/Kagel Canyons	195
248	Acton	166
249	Irwindale	154
250	Hasley Canyon	136
251	Unincorporated Santa Monica Mountains	100
252	Agua Dulce	99
253	Leona Valley	90
254	Industry	82
255	Lake Hughes	61
256	Unincorporated Santa Susana Mountains	58
257	Castaic Canyons	40
258	Southeast Antelope Valley	27
259	Vernon	18
260	Northwest Antelope Valley	16
261	Tujunga Canyons	11
262	Northeast Antelope Valley	10
263	Ridge Route	7
264	Angeles Crest	3
265	Unincorporated Catalina Island	2

TAB I

AFFIDAVIT OF MAILING

ZONING ADMINISTRATOR CASE NO. ZA 17528 (PAD)

I, Cynthia Geronilla, certify that I am an employee of the City of Los Angeles, DEPARTMENT OF CITY PLANNING, State of California, and I did, on the 3rd day of December, 1999, mail, postage prepaid, to the applicant and all parties required by the Municipal Code, as detailed on the official ownership list, a copy of the determination, a true copy of which is attached.

<u>✓</u>	Applicant
<u>✓</u>	Representative
<u>✓</u>	Adjoining Property Owners
<u>✓</u>	Council District
<u> </u>	Names on Sign-In Sheet
<u> </u>	Other

There is a regular daily service by mail between the City of Los Angeles and each of the addresses were sent a copy of the determination.

30800100247

CITY OF LOS ANGELES

CALIFORNIA



RICHARD J. RIORDAN
MAYOR

DEPARTMENT OF
CITY PLANNING
CON HOWE
DIRECTOR

FRANKLIN P. EBERHARD
DEPUTY DIRECTOR

OFFICE OF ZONING ADMINISTRATION

221 NORTH FIGUEROA STREET
ROOM 1500
LOS ANGELES, CA 90012-2601
(213) 580-5495
FAX: (213) 580-5569

December 3, 1999

Nuevo Energy Company (A)(O)
3019-23 Budlong Avenue and
3020-24 Van Buren Place
Los Angeles, CA 90007

Stephen T. Burke (R)
1800 30th Street, #200
Bakersfield, CA 93301

Department of Building and Safety

CASE NO. ZA 17528(PAD)
APPROVAL OF PLANS
3019-23 Budlong Avenue and
3020-24 Van Buren Place
South Central Planning Area
Zone : RD1.5-0 and R2-1-0
D. M. : 120B197
C. D. : 8
CEQA : CE 99-0804-PAD
Fish and Game: Exempt
Legal Description: Lots 11, 12, 19, 20,
Block G. Poole and Jones Tract

Pursuant to Los Angeles Municipal Code Section 13.01, I hereby APPROVE:

a modification to existing conditions controlling drilling and production operations to be followed in the drilling and production of oil and gas on a site classified in the R2-1-0 and RD1.5-1-0 Zones involving Oil Drilling District No. U-124,

with said conditions stipulated as follows.

1. With the exception of Condition No. 4, all of the original conditions of ZA 17528 as approved on April 29, 1965 shall remain in full force and effect.
2. Condition No. 4 of ZA 17528 is modified to read as follows:

As long as the subject site is utilized for oil drilling and production purposes, Lots 11 and 20 of Block G of the Poole and Jones Tract, adjoining the northerly side of the site, shall be retained as a buffer to the oil drilling site. The existing dwellings or suitable replacement dwellings approved by the Department of Building and Safety, and conforming to all zoning regulations, shall be retained to serve as a buffer between the site and the adjacent lots to the north. Furthermore, the oil well drilling equipment and future production equipment shall be located on the site in substantial conformance with the plot plan, Exhibit 13, attached to the file, with any oil well located at least 50 feet from the exterior property lines of the site. It is understood that this initial grant does not authorize all of the



30300100248

future oil wells indicated on said Exhibit 13 and that greater setbacks may be specified by the Fire Department in compliance with the provisions of Article 7, Chapter 5 of the Municipal Code. The nature of projections permitted in the building line spaces established by ordinance on the R Zone lots abutting both Van Buren Place and Budlong Avenue shall be as specified in the grant under companion Yard Variance Case No. 13903.

3. Lots 11 and 20 of Block G of Pool and Jones Tract shall remain as buffer properties to the adjacent oil drilling site. The existing residential structures shall remain on the property. In the event these structures are removed or otherwise destroyed, similar replacement residential structures shall be erected on the property by the owner in order to retain the buffer required for the oil drilling site.

OBSERVANCE OF CONDITIONS - TIME LIMIT - LAPSE OF PRIVILEGES - TIME EXTENSION

All terms and conditions of the approval shall be fulfilled before the use may be established. The instant authorization is further conditional upon the privileges being utilized within two years after the effective date of approval and, if such privileges are not utilized or substantial physical construction work is not begun within said time and carried on diligently to completion, the authorization shall terminate and become void. A Zoning Administrator may extend the termination date for one additional period not to exceed one year, if a written request on appropriate forms, accompanied by the applicable fee is filed therefore with a public Office of the Department of City Planning setting forth the reasons for said request and a Zoning Administrator determines that good and reasonable cause exists therefore.

TRANSFERABILITY

This authorization runs with the land. In the event the property is to be sold, leased, rented or occupied by any person or corporation other than yourself, it is incumbent that you advise them regarding the conditions of this grant.

VIOLATIONS OF THESE CONDITIONS, A MISDEMEANOR

Section 12.24-J,3 of the Los Angeles Municipal Code provides:

"It shall be unlawful to violate or fail to comply with any requirement or condition imposed by final action of the Zoning Administrator, Board or Council pursuant to this subsection. Such violation or failure to comply shall constitute a violation of this Chapter and shall be subject to the same penalties as any other violation of this Chapter."

Every violation of this determination is punishable as a misdemeanor and shall be punishable by a fine of not more than \$1,000 or by imprisonment in the county jail for a period of not more than six months, or by both such fine and imprisonment.

30300100249

APPEAL PERIOD - EFFECTIVE DATE

30000100250

The applicant's attention is called to the fact that this grant is not a permit or license and that any permits and licenses required by law must be obtained from the proper public agency. Furthermore, if any condition of this grant is violated or if the same be not complied with, then the applicant or his successor in interest may be prosecuted for violating these conditions the same as for any violation of the requirements contained in the Municipal Code. THE ZONING ADMINISTRATOR'S DETERMINATION IN THIS MATTER WILL BECOME EFFECTIVE AFTER DECEMBER 20, 1999, UNLESS AN APPEAL THEREFROM IS FILED WITH THE BOARD OF ZONING APPEALS. IT IS STRONGLY ADVISED THAT APPEALS BE FILED EARLY DURING THE APPEAL PERIOD AND IN PERSON SO THAT IMPERFECTIONS/ INCOMPLETENESS MAY BE CORRECTED BEFORE THE APPEAL PERIOD EXPIRES. ANY APPEAL MUST BE FILED ON THE PRESCRIBED FORMS, ACCOMPANIED BY THE REQUIRED FEE, A COPY OF THE ZONING ADMINISTRATOR'S ACTION, AND RECEIVED AND RECEIPTED AT A PUBLIC OFFICE OF THE DEPARTMENT OF CITY PLANNING ON OR BEFORE THE ABOVE DATE OR THE APPEAL WILL NOT BE ACCEPTED. SUCH OFFICES ARE LOCATED AT:

Figueroa Plaza
201 North Figueroa Street, #300
Los Angeles, CA 90012
(213) 977-6083

6251 Van Nuys Boulevard
First Floor
Van Nuys, CA 91401
(818) 756-8596

NOTICE

THE APPLICANT IS FURTHER ADVISED THAT ALL SUBSEQUENT CONTACT WITH THIS OFFICE REGARDING THIS DETERMINATION MUST BE WITH THE ZONING ADMINISTRATOR WHO ACTED ON THE CASE. THIS WOULD INCLUDE CLARIFICATION, VERIFICATION OF CONDITION COMPLIANCE AND PLANS OR BUILDING PERMIT APPLICATIONS, ETC., AND SHALL BE ACCOMPLISHED BY APPOINTMENT ONLY, IN ORDER TO ASSURE THAT YOU RECEIVE SERVICE WITH A MINIMUM AMOUNT OF WAITING. YOU SHOULD ADVISE ANY CONSULTANT REPRESENTING YOU OF THIS REQUIREMENT AS WELL.

FINDINGS OF FACT

After thorough consideration of the statements contained in the application and documents submitted therewith, the report of the Zoning Analyst thereon, and a review of Case No. ZA17528, all of which are by reference made a part hereof, as well as knowledge of the property and the surrounding district, I find as follows:

BACKGROUND

The portions of the subject property to be sold consists of level, rectangular-shaped interior parcels consisting of four record lots and a total of 26,424 square feet and a combined frontage of approximately 100 feet on the west side of Budlong Avenue and

100 feet on the east side of Van Buren Place. These parcels also have a uniform depth of 132.2 feet. The properties involved have 2, two-story, badly deteriorated four-plex residential units which are presently unoccupied and two lots that are vacant.

Surrounding properties are within the RD1.5-1 and R2-1-0 Zones and are characterized by level topography and improved streets. The surrounding properties are developed with one- and two-story single-family dwellings and multiple family dwellings.

Budlong Avenue, adjoining the subject property to the east, is a designated Local Street dedicated a width of 60 feet and improved with curb, gutter and sidewalk.

Van Buren Place, adjoining the subject property to the west, is a designated Collector Street dedicated a width of 60 feet and improved with curb, gutter and sidewalk.

Previous zoning related actions on the site/in the area include:

Subject Property:

Case No. ZA 17528(PAD) - On April 29, 1965, the Zoning Administrator approved determinations of conditions and methods of operation to be followed in drilling for and production of oil and gas on an approximately 2 acre site classified in the C2 and R3-1 Zones in impending Oil Drilling District No. U-124.

Case No. CPC 29708 - On April 23, 1982 Ordinance No. 156,356 was published for a change of zone from R3-1-0 and R4-1-0 to R2-1-0 for property bounded by Adams Boulevard, Vermont Avenue, Jefferson Boulevard and Normandie Avenue which includes the subject property.

Case No. CPC 29708 - On June 22, 1982 Ordinance No. 156,833 was published effectuating a zone change R2-1 to RD1.5-1-0.

Records provided in the DAFS shows various building code problems relating to the existing buildings. The existing residential structures are badly deteriorated and are in need of extensive work to make them habitable.

Surrounding Properties:

No similar or relevant cases were found on surrounding properties in the immediate neighborhood.

FINDINGS

1. The subject property is a level, rectangular shaped group of interior parcels consisting of four record lots, lots 11, 12, 19, and 20 of Block G of Poole and Jones Tract, and totaling approximately 24,424 square feet in area. The lots have a combined frontage of 100 feet on the westerly side of Budlong Avenue and 100 feet of frontage on the east side of Van Buren Place. These parcels

30000100251


also have a uniform depth of approximately 132 feet each. Two of the lots, 12 and 19 are presently vacant. The remaining two lots, 11 and 20, are developed with older, deteriorating two-story residential structures.

2. The applicant, Nuevo Energy Company, successor owner to Union Oil Co. now desires to sell two of these parcels, Lots 11 and 20, to Southern Asset Company. These two parcels buffer the remainder of the community from the oil drilling site situated on properties to the south.
3. A review of the historical record indicates that on April 29, 1965, Union Oil Company was approved to develop and operate a controlled drill site on Lots 1, 2, 3, 4, 7, 8, 9, 10, 21, 22, 23 and 24 of Block G of Poole and Jones tract. Condition No. 4 of that grant required that for the life of the drill site, Lots 11 and 20 of said tract shall be retained in common ownership with the oil drilling site, with the dwellings or replacement dwellings to be retained in order to serve as a buffer to the adjacent lots to the north. In that analysis the Zoning Administrator found that the applicant also owned the two lots to the north that immediately adjoin the oil drilling site and determined that these two lots should be retained as a buffer between the oil drilling site and the solidly developed residential area to the north on the same block. The purpose of retaining these two lots as a buffer was to assure that the oil drilling operations would be suitably buffered from the residential uses in close proximity to the oil drilling and production site. With the normal care and maintenance of such an oil site, the added buffer would further insulate the residential community from possible adverse impacts associated with oil drilling and production activities.
4. The intent of the original Condition No. 4 was principally to provide said buffer so long as the oil drilling operations were being conducted on the approved oil drilling site. The fact that the lots were to be retained in common ownership with the site was only incidental and anecdotal as the property was all under the same ownership. The intent of this condition will be served no matter the ownership of the property so long as the lots are retained as a buffer to the oil drilling and production site and so long as residential structures are retained on the property. It appears, from statements made by the applicant, that this is the intent of the prospective owner of the property. The intent is to renovate the existing structures with the further possible intent of using the properties for student housing associated with the nearby University of Southern California campus. The primary change will be ownership of the property, not the function of the property as a buffer for the adjacent drill site.
5. The South Central Los Angeles Community Plan designates the subject property for Low Medium II and Low Medium I density residential development, with corresponding zones of RD2, RD1.5, R2 and RD3, 4, and 5. The existing residential development on the subject property conforms to the Plan and retention through renovation or replacement with similar housing will enforce the spirit and intent of the plan.

30800100252

ADDITIONAL MANDATORY FINDINGS

6. The National Flood Insurance Program rate maps, which are a part of the Flood Hazard Management Specific Plan adopted by the City Council by Ordinance No. 154,405, have been reviewed and it has been determined that this project is located in Zone B, areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 foot or where the contributing drainage area is less than 1 square mile; or areas protected by levees from the base flood. (Medium shading)
7. On September 7, 1999, the subject project was issued a Notice of Exemption (Article III, Section 3, City CEQA Guidelines), log reference CE 99-0804-PAD, for a Categorical Exemption, Class 5, Category 11, City CEQA Guidelines, Article VII, Section 1, State EIR Guidelines, Section 15100. I hereby certify that action.
8. Fish and Game: The subject project, which is located in Los Angeles County, will not have an impact on fish or wildlife resources or habitat upon which fish and wildlife depend, as defined by California Fish and Game Code Section 711.2.



LEONARD S. LEVINE
Associate Zoning Administrator
Direct Telephone No. (213) 580-5490

LSL:lmc

cc: Councilmember Ridley-Thomas
Eighth District
Adjoining Property Owners
Fire Department, Bureau of Fire
Prevention and Public Safety
City Administrative Officer
County Assessor

30600100253

Pola L Rich
1350 W Jefferson Blvd
Los Angeles CA 90007-3451

Hasmukh B & Gita Patel
265 S St Andrews Pl
Los Angeles CA 90004-5029

Fernando & Dolores Ibarra
2119 Adona Dr
Lomita CA 90717-1102

Javier Rojas
3015 Van Buren Pl
Los Angeles CA 90007-2806

Edna M Brown
3023 Van Buren Pl 1/2
Los Angeles CA 90007-2806

Marubayashi Morihiro K Co Tr
3027 Van Buren Pl
Los Angeles CA 90007-2806

Everett J Haack
954 Arroyo Dr
South Pasadena CA 91030-2900

Raquel C & Antonio Luna
3105 Van Buren Pl
Los Angeles CA 90007-2808

Aurora Clayton
136 E Elmbrake Ln
Montebello CA 90640-2116

Rodger E & Celestine Polk
2429 11th Ave
Los Angeles CA 90018-1769

Lillian Marenco
3013 Budlong Ave
Los Angeles CA 90007-2862

Rodolfo & Diego Olivares
1438 W 30th St
Los Angeles CA 90007-2869

Henry Walker
1446 W 42 Pl
Los Angeles CA 90062-1836

Nun H Mam
3010 Budlong Ave
Los Angeles CA 90007-2861

Joseph P Caziere
3030 Budlong Ave
Los Angeles CA 90007-2861

Ernest A & Marlene Reyes
3042 Budlong Ave
Los Angeles CA 90007-2861

Virginia Navarrete
3100 Budlong Ave
Los Angeles CA 90007-2863

Q C Kelker
3104 Budlong Ave
Los Angeles CA 90007-2863

Lois M Powell
3915 S 700 W 21
Salt Lake City UT 84123-7714

Mark E & Maria Wade
5104 3rd Ave
Los Angeles CA 90043-1939

30000100254

ZA 17528

Robert & Phyllis Josephson
4452 Irvine Ave
North Hollywood CA 91602-1914

*** 21 Printed ***

30000100255

ZA 17528

TAB J

LOCAL / L.A. Now

Neighbors push back against drilling plan at South L.A. site



DonnaAnn Ward, founder of Cowatching Oil L.A., stands in front of a drilling site at Jefferson and Budlong Avenues on February 26, 2014 in Los Angeles, California. (Gina Ferazzi / Los Angeles Times)



By **Emily Alpert Reyes** • Contact Reporter

NOVEMBER 25, 2014, 5:04 PM

Neighbors are pressing for an environmental study of oil drilling at a South Los Angeles location close to homes, arguing that the city should scrutinize fumes, noise and chemical usage before deciding whether to let the company drill wells at the site.

The Freeport-McMoRan petroleum company wants to drill a new well and redrill two existing ones at the Jefferson Boulevard site, located west of USC. The site is ringed by a wall, but nearby buildings overlook the drilling operations.

The company argues that no study of the project is needed under the California Environmental Quality Act. In a written statement, Freeport-McMoRan spokesman Eric Kinneberg said the project is “minimal

in scope and duration” and would be done within roughly four months.

"What we are proposing ... is exactly the same thing that's been going on since 1965," said L. Rae Connet of Petroland Services, which represented Freeport-McMoRan at a City Hall hearing on Tuesday.

But neighbors and community activists argue that drilling at the site has caused longstanding nuisances and dangers, including acrid fumes and deafening noise.

Richard [Parks](#), board president of a nonprofit in the area, said that when trucks filled with acid pulled up to the site in July, workers in head-to-toe protective gear toiled a short distance from apartments. Residents were given scant notice about the activity, he said.

"This should not be happening," said resident Corissa Pacillas, adding that she and her husband worry about how chemicals used at the site might affect children they might have in the future.

Three years ago, oil droplets drifted onto an apartment building and cars parked nearby, Parks said. Community activists also argued that Freeport-McMoRan wasn't complying with a requirement to own and maintain two nearby properties as a buffer between neighbors and the drilling site.

At a Tuesday hearing, the company said the city had allowed an earlier owner to sell the properties, ending that requirement. It argued that many of the chemicals that worried neighbors were commonly used in household products.

Near the end of the hearing, an aide to Councilman Bernard Parks -- whose South Los Angeles district includes the drilling site -- said the councilman wanted to bring both sides together to create a working document containing rules for how the site should operate.

Tuesday's hearing ended without a decision on the drilling proposal. Associate zoning administrator Maya Zaitzevsky said she would accept information and comments on the proposal until early January.

Follow [@latimesemily](#) for what's happening at Los Angeles City Hall

Copyright © 2016, Los Angeles Times

This article is related to: [Bernard Parks](#)

Decision delayed on expanded oil drilling in West Adams

A decision on whether to permit expanded oil drilling in a South Los Angeles neighborhood has been delayed after about a hundred residents turned out to a hearing to oppose the plan.

At issue was whether the company Freeport McMoRan could drill one new well and redrill two others at a site in the 1300 block of Jefferson Blvd bordered by homes on three other sides. So many people turned out for the hearing at L.A. City Hall, an overflow room had to be set up.

Permit approvals like this have been routine in the past. But zoning administrator Maya Zaitzevsky said it'll take time to analyze new evidence and testimony, including in a 63-page letter from community groups.

Neighbors say they're worried about well operations that can bring as much as 24,000 pounds of acid to the Jefferson drill site at one time.

Petroleum consultant Rae Connet, appearing at the hearing on behalf of Freeport, told Zaitzevsky that acid and other chemicals used in drilling are common and safe.

"For hydrochloric acid, for example, It's in Herbal Essence Shampoo," Connet said. "It's in febreze air effects, it's in Terra pond fish treatments and Lysol brand toilet cleaner." Connet went on to detail products carrying formaldehyde, and would have continued, but she was interrupted. "I get, I get the point," the zoning administrator said.

A spokesman for Councilman Bernard Parks, who represents the area, said the councilman will host a meeting among drilling opponents and Freeport McMoRan to try to hammer out an agreement so that operations can proceed.

No decision is expected until January 5th at the earliest.

Zoning officer puts off decision on urban oil field in South Los Angeles

John
Schreiber

A city zoning officer put off a decision Tuesday on allowing a South Los Angeles oil drilling project after hearing more than two hours of testimony from dozens of residents calling for a formal environmental review of the plan.

Phoenix-based Freeport-McMoRan Inc., known as one of the world's biggest producers of copper and gold, wants to drill a new injection well and re-drill two other wells at 1371 W. Jefferson Blvd. The site known as the Jefferson Drill Site was established in 1965, and Freeport wants to be exempted from doing a formal environmental impact review as required under the California Environmental Quality Act.

More than 100 people packed the Office of Zoning Administration's public hearing at City Hall, many to protest Freeport McMoRan's request for the exemption.

Some who said they live a mile or less from the site contend an environmental impact review is needed to make public what kind of chemicals are being used and their potential effects on neighboring communities.

Company representatives said the drilling will be done within the existing facility at Jefferson Boulevard and Budlong Avenue and does not exceed the number of wells already authorized there.

A consultant for Freeport McMoRan said no hydraulic fracturing was anticipated, nor was acidization or other unconventional well-stimulation techniques. The planned wells, she said, will use "conventional" drilling and extraction methods.

After more than two hours of testimony, zoning officer Maya Zaitzevsky opted to delay her decision until Jan. 5, saying she needed more time to review information recently given to her.

She said she has limited ability in deciding how oil drilling and fracking activities are handled in Los Angeles. She urged the residents to work with city leaders to help sort out issues regarding oil production and fracking.

"Whether it's right or wrong, whether it's too limited — it's not for to me to change or to make a judgment on it. It is what it is," Zaitzevsky said, addressing opponents of the drilling project.

"And I definitely understand your concerns that it seems sort of, you know, strange to act on a case in 2014 or (2015) based on zoning code provisions that were developed in the 1950s or '60s and haven't really been modified in that period of time," she said.

"I'm not a legislative body. I cannot change laws. I can only act on what I have before me," Zaitzevsky said.

An aide to City Councilman Bernard Parks, whose district includes the site, asked for a decision to be put off for 30 days to enable Freeport and residents to meet and discuss concerns about the project.



Los Angeles City Hall. Photo by John Schreiber.

Council members seeking to regulate fracking in Los Angeles recently faced a hiccup after a planning official failed to hand up ordinance that would halt such practices in the city. The planning official delivered a report, saying the city lacks an “expert in petroleum and natural gas engineering or geology” to guide the drafting of a fracking ban.

Residents told Zaitzevsky today operations at the Jefferson site created “deafening” noises. They said they believed chemicals used at the site may have damaged nearby trees and plants.

An area resident, Anna Parks, said her children attended a summer camp about 300 feet away from the site.

“As their mother, it’s my responsibility to know what they are breathing during that time” and to make sure they are not exposed to harmful fumes, Parks said. “I don’t have a way to research that and find out what they’re breathing, so I’m here to respectfully request the city require an environmental impact report and an extensive study be done.”

L. Rae Connet of Petro Land Services, who spoke on behalf of Freeport, said “we are aware that there has been heightened concern” about oil drilling both nationally and locally, and the company takes those concerns “very seriously.”

She said the company responded in writing to residents who expressed concerns.

“We don’t mean to diminish any of those concerns, but it’s also significant that this applicant is complying with the law and is listening to its neighbors,” Connet said.

“Unfortunately people like to paint one facility with negativity that comes from another facility. It’s important that we look at the track record of this facility,” she said. “This facility has an exemplary safety record.”

Representatives of Stand Together Against Neighborhood Drilling, or STAND-LA, who oppose the project, contend that “noxious fumes, loud noises, heavy truck traffic and the injection of corrosive acids” would harm the surrounding community.

Freeport issued a statement this week saying their proposal “is minimal in scope and duration and falls far below the threshold for which an environmental review under CEQA (the California Environmental Quality Act) is triggered.”

The 120-day-long project “is consistent with the historical types of operations for which the site has been zoned since the 1960s,” according to the company with nearly \$19 billion in revenue last year.

Two of the proposed wells would fall under the “Oil Well Class B” category, which are used for “the subsurface injection into the earth of oil field waste, gases, water or liquid substances,” according to city planners.

A third proposed well would be classified as an “Oil Well Class A,” which is “intended to be used for the production of petroleum.”

— *City News Service*

TAB K



Chemco Products Company

"Your Partner in Success"

[GREEN STATEMENT](#)[INDUSTRIES SERVED](#)[COMPANY PROFILE](#)[CONTACT US](#)[SITEMAP](#)

- Food Dairy & Beverage ▶
- Water Treatment ▶
- Industrial ▶
- Metal Finishing ▶
- Institutional & Janitorial ▶
- Other Specialties ▶
- Engineering ▶



"Complete Line of Quality Products at Competitive Prices."

INDUSTRIAL - OIL INDUSTRY

Products

- | | |
|--------------------------------------|---|
| Heavy Duty Degreasers: | Low V.O.C. cleaners designed to remove oil and grease from all painted and unpainted surfaces |
| Mild Alkaline Cleaners: | Designed for steam cleaning & degreasing of heavy oils from offshore platform decks, cellar units, floors & walls, and all types of drilling equipment |
| Natural Solvent Degreasers: | High foaming cleaners designed to remove heavy oils without the use of petro-chemical solvents, harsh alkalis or other toxic chemicals. |
| Ready to Use Detergents: | Designed to remove oils and greases from hard surfaces such as concrete, painted or unpainted surfaces. These products are exempt from A.Q.M.D. record keeping due to the low V.O.C. levels. |
| Concentrated Detergents: | Designed to be diluted on-site through foaming units for heavy-duty degreasing. The advantage is less storage space is required for the chemical and the cost of shipping is less. |
| Sweetening and de-oiling Detergents: | Designed for use in Chem-Cleaning of heavy crude in Coker Units, Crude Units, FCC, HDS, Hydrocracker, and clean up operations. |
| Asphalt Release Products: | Designed to remove heavy oils and grease from all surfaces. Completely biodegradable and will satisfy Environmental Regulatory Compliance goals with out sacrificing performance. |
| Odor Control Products: | Concentrated liquid compounds designed to neutralize and eliminate odors. Complies with all V.O.C. Regulatory Guidelines under Rule 1171, is safe, non-toxic and biodegradable. Designed to be used through a Mistig System, Vacuum Truck Exhaust Systems, Drains, Grease Traps, Sumps, or wherever foul odors exist. These products neutralize H2S odors very effectively. |



TAB L

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Product name : **Odor Control Jasmine**
Product code : 11585

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Odor Control

1.3. Details of the supplier of the safety data sheet

Flo-Kem
19402 Susana Rd.
Rancho Dominguez, CA 90221 - USA
T 310-632-7124 - F 310-631-7496
<http://www.flo-kem.com>

1.4. Emergency telephone number

Emergency number : CHEMTEL: 800-255-3924

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Flam. Liq. 3 H226
Eye Dam. 1 H318
Skin Sens. 1 H317
Repr. 2 H361

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms



Signal word

: Danger

Hazard statements

: Flammable liquid and vapor.
May cause an allergic skin reaction.
Causes serious eye damage.
Suspected of damaging fertility or the unborn child.

Precautionary statements

: Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, lighting, ventilating equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Avoid breathing mist, vapors.
Contaminated work clothing must not be allowed out of the workplace.
Wear eye protection, protective gloves, protective clothing.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
Wash with plenty of soap and water.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If exposed or concerned: Get medical advice/attention.
Immediately call a POISON CENTER or doctor/physician.

Odor Control Jasmine

Safety Data Sheet

If skin irritation or rash occurs: Get medical advice/attention.

Take off contaminated clothing and wash before reuse.

In case of fire: Use alcohol resistant foam, BC-powder, carbon dioxide (CO₂), dry chemical, sand to extinguish.

Store in a well-ventilated place. Keep cool.

Store locked up.

Dispose of contents/container in accordance with Local, State, and Federal regulations.

2.3. Hazard not otherwise classified (HNOC)

No additional information available

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

(NOTE: If component displays the * (asterisk) symbol, the following statement applies.)

*Chemical name, CAS number and/or exact concentration have been withheld as a trade secret

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	Classification (GHS-US)
2-propanol	(CAS No) 67-63-0	1 - 5	Flam. Liq. 2, H225 Eye Irrit. 2A, H319 STOT SE 3, H336
4-nonylphenol, branched, ethoxylated	(CAS No) 127087-87-0	1 - 5	Skin Irrit. 2, H315 Eye Dam. 1, H318
4-methylanisole	(CAS No) 104-93-8	< 1	Flam. Liq. 3, H226 Acute Tox. 4 (Oral), H302 Skin Irrit. 2, H315 Eye Irrit. 2A, H319 Repr. 2, H361 Aquatic Chronic 3, H412
alpha-hexylcinnamaldehyde	(CAS No) 101-86-0	< 1	Skin Irrit. 2, H315 Skin Sens. 1, H317

(NOTE: If component displays the * (asterisk) symbol, the following statement applies.)

*Chemical name, CAS number and/or exact concentration have been withheld as a trade secret

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general	: Never give anything by mouth to an unconscious person. If exposed or concerned: Get medical advice/attention.
First-aid measures after inhalation	: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If you feel unwell, seek medical advice.
First-aid measures after skin contact	: If skin irritation or rash occurs: Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse. Wash with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation persists, get medical attention.
First-aid measures after eye contact	: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
First-aid measures after ingestion	: Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries	: Not expected to present a significant hazard under anticipated conditions of normal use. If exposed or concerned: Get medical advice/attention.
Symptoms/injuries after skin contact	: May cause an allergic skin reaction. May cause slight irritation. Repeated exposure may cause skin dryness or cracking.
Symptoms/injuries after eye contact	: Causes serious eye damage.
Symptoms/injuries after ingestion	: FOLLOWING SYMPTOMS MAY APPEAR LATER: Gastrointestinal complaints. Irritation of the gastric/intestinal mucosa. Irritation of the oral mucous membranes. Nausea.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	: Alcohol-resistant foam. BC powder. Carbon dioxide. Dry chemical powder. Sand/earth.
------------------------------	---

Odor Control Jasmine

Safety Data Sheet

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Flammable liquid and vapor.
Reactivity : Reacts with (strong) oxidizers.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.
Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.
Other information : Although product has a flash point <200° F, it is an aqueous solution and does not sustain combustion.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Isolate from fire, if possible, without unnecessary risk. Use special care to avoid static electric charges.

6.1.1. For non-emergency personnel

Protective equipment : Protective goggles.
Protective gloves.
Protective clothing.
Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.
Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Contain released substance, pump into suitable containers. Plug the leak, cut off the supply.
Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials. Wash down leftovers with plenty of water. Wash clothing and equipment after handling.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Handle empty containers with care because residual vapors are flammable.
Precautions for safe handling : Do not get in eyes, on skin, or on clothing. Do not breathe mist, vapors. Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Observe normal hygiene standards. Provide good ventilation in process area to prevent formation of vapor. Provide local exhaust or general room ventilation. Take precautionary measures against static discharge. Use only outdoors or in a well-ventilated area. Use personal protective equipment as required.
Hygiene measures : Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink or smoke when using this product. Wash contaminated clothing before reuse. Wash hands and forearms thoroughly after handling. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Provide local exhaust or general room ventilation. Take precautionary measures against static discharge. Comply with applicable regulations.
Incompatible products : Reducing agents. Oxidizing agent.
Storage area : Store in a cool, dry well-ventilated area. Keep container tightly closed when not in use.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Odor Control Jasmine

Safety Data Sheet

2-propanol (67-63-0)		
ACGIH	ACGIH TWA (ppm)	200 ppm
ACGIH	ACGIH STEL (ppm)	200 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	980 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	400 ppm
OSHA	OSHA PEL (STEL) (mg/m³)	1225 mg/m³
OSHA	OSHA PEL (STEL) (ppm)	500 ppm

8.2. Exposure controls

Personal protective equipment	: Avoid all unnecessary exposure.
Hand protection	: Wear protective gloves.
Eye protection	: Chemical goggles or safety glasses.
Skin and body protection	: Wear suitable protective clothing.
Respiratory protection	: Where exposure through inhalation may occur from use, respiratory protection equipment is recommended. In case of insufficient ventilation, wear suitable respiratory equipment.
Other information	: When using, do not eat, drink or smoke.
Appropriate engineering controls	: Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Color	: Clear pink
Odor	: Jasmine
Odor threshold	: No data available
pH	: 7 - 8
Melting point	: No data available
Freezing point	: No data available
Boiling point	: No data available
Flash point	: > 125 °F
Relative evaporation rate (butyl acetate=1)	: No data available
Flammability (solid, gas)	: No data available
Explosive limits	: No data available
Vapor pressure	: No data available
Vapor density	: No data available
Specific Gravity @ 77° F	: 0.982 - 1.002
Solubility	: Soluble in water.
Partition Coefficient n-Octanol-Water	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Viscosity	: No data available

9.2. Other information

VOC content	: < 70 g/l CARB VOC
-------------	---------------------

SECTION 10: Stability and reactivity

10.1. Reactivity

Reacts with (strong) oxidizers.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Not established.

Odor Control Jasmine

Safety Data Sheet

10.4. Conditions to avoid

Extremely high or low temperatures. Open flame. Heat. Sparks.

10.5. Incompatible materials

Oxidizers. Reducing agents.

10.6. Hazardous decomposition products

Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

2-propanol (67-63-0)	
LD50 oral rat	5045 mg/kg (Rat; OECD 401: Acute Oral Toxicity; Experimental value; 5840 mg/kg bodyweight; Rat)
LD50 dermal rabbit	12870 mg/kg (Rabbit; Experimental value; Equivalent or similar to OECD 402; 16.4; Rabbit)
LC50 inhalation rat (mg/l)	73 mg/l/4h (Rat)
ATE US (oral)	5045.000 mg/kg body weight
ATE US (dermal)	12870.000 mg/kg body weight
ATE US (vapors)	73.000 mg/l/4h
ATE US (dust, mist)	73.000 mg/l/4h
4-methylanisole (104-93-8)	
LD50 oral rat	1920 mg/kg (Rat)
LD50 dermal rabbit	> 5000 mg/kg (Rabbit)
LC50 inhalation rat (mg/l)	> 6.1 mg/l/4h (Rat)
ATE US (oral)	1920.000 mg/kg body weight
alpha-hexylcinnamaldehyde (101-86-0)	
LD50 oral rat	3100 mg/kg (Rat)
LD50 dermal rabbit	> 3000 mg/kg (Rabbit)
ATE US (oral)	3100.000 mg/kg body weight
4-nonylphenol, branched, ethoxylated (127087-87-0)	
LD50 oral rat	16000 mg/kg (Rat)
LD50 dermal rabbit	4490 mg/kg (Rabbit)
ATE US (oral)	16000.000 mg/kg body weight
ATE US (dermal)	4490.000 mg/kg body weight

Skin corrosion/irritation : Not classified
pH: 7 - 8

Serious eye damage/irritation : Causes serious eye damage.
pH: 7 - 8

Respiratory or skin sensitization : May cause an allergic skin reaction.

Germ cell mutagenicity : Not classified
Based on available data, the classification criteria are not met

Carcinogenicity : Not classified

2-propanol (67-63-0)	
IARC group	3 - Not Classifiable

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met

Symptoms/injuries after skin contact : May cause an allergic skin reaction. May cause slight irritation. Repeated exposure may cause skin dryness or cracking.

Odor Control Jasmine

Safety Data Sheet

Symptoms/injuries after eye contact	: Causes serious eye damage.
Symptoms/injuries after ingestion	: FOLLOWING SYMPTOMS MAY APPEAR LATER: Gastrointestinal complaints. Irritation of the gastric/intestinal mucosa. Irritation of the oral mucous membranes. Nausea.

SECTION 12: Ecological information

12.1. Toxicity

2-propanol (67-63-0)	
LC50 fish 1	4200 mg/l (96 h; Rasbora heteromorpha; Flow-through system)
EC50 Daphnia 1	> 10000 mg/l (48 h; Daphnia magna)
LC50 fish 2	9640 mg/l (96 h; Pimephales promelas; Lethal)
EC50 Daphnia 2	13299 mg/l (48 h; Daphnia magna)
Threshold limit algae 1	> 1000 mg/l (72 h; Scenedesmus subspicatus; Growth rate)
Threshold limit algae 2	1800 mg/l (72 h; Algae; Cell numbers)
4-methylanisole (104-93-8)	
LC50 fish 1	46 - 100 mg/l (96 h; Leuciscus idus)
EC50 Daphnia 1	44.2 mg/l (48 h; Daphnia magna)
EC50 Daphnia 2	41.2 mg/l (24 h; Daphnia magna)
Threshold limit algae 1	320 mg/l (72 h; Scenedesmus subspicatus)

12.2. Persistence and degradability

2-propanol (67-63-0)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Biodegradable in the soil under anaerobic conditions. No (test) data on mobility of the substance available.
Biochemical oxygen demand (BOD)	1.19 g O ₂ /g substance
Chemical oxygen demand (COD)	2.23 g O ₂ /g substance
ThOD	2.40 g O ₂ /g substance
BOD (% of ThOD)	0.49 % ThOD
4-methylanisole (104-93-8)	
Persistence and degradability	Inherently biodegradable. Not readily biodegradable in water.
alpha-hexylcinnamaldehyde (101-86-0)	
Persistence and degradability	Readily biodegradable in water.
4-nonylphenol, branched, ethoxylated (127087-87-0)	
Persistence and degradability	Biodegradable in water. No (test) data on mobility of the substance available.

12.3. Bioaccumulative potential

2-propanol (67-63-0)	
Log Pow	0.05 (Experimental value)
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).
4-methylanisole (104-93-8)	
Log Pow	2.66 - 2.74
Bioaccumulative potential	Low potential for bioaccumulation (Log Kow < 4).
alpha-hexylcinnamaldehyde (101-86-0)	
BCF other aquatic organisms 1	3120
Log Pow	4.7
Bioaccumulative potential	Potential for bioaccumulation (500 ≤ BCF ≤ 5000).
4-nonylphenol, branched, ethoxylated (127087-87-0)	
Bioaccumulative potential	Low potential for bioaccumulation (molecular mass ≥ 700 g/mol).

12.4. Other adverse effects

Other information	: Avoid release to the environment.
-------------------	-------------------------------------

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations	: Dispose of contents/container in accordance with Local, State, and Federal regulations.
Additional information	: Handle empty containers with care because residual vapors are flammable.

Odor Control Jasmine

Safety Data Sheet

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

14.1. UN Number

UN-No.(DOT) : Not Regulated
Other information : Although product has a flash point <200° F, it is an aqueous solution and does not sustain combustion.

14.2. UN proper shipping name

DOT Proper Shipping Name : Not Regulated

SECTION 15: Regulatory information

15.1. US Federal regulations

All components of this product are listed on the Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

2-propanol (67-63-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes	Delayed (chronic) health hazard Immediate (acute) health hazard Fire hazard
-------------------------------------	---

4-methylanisole (104-93-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes	Fire hazard Immediate (acute) health hazard Delayed (chronic) health hazard
-------------------------------------	---

alpha-hexylcinnamaldehyde (101-86-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard
-------------------------------------	---------------------------------

4-nonylphenol, branched, ethoxylated (127087-87-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard
-------------------------------------	---------------------------------

15.2. International regulations

CANADA

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

SECTION 16: Other information

Abbreviations Legend:

Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
---------------------	----------------------------------

Odor Control Jasmine

Safety Data Sheet

Aquatic Chronic 3	Hazardous to the aquatic environment - Chronic Hazard Category 3
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Eye Irrit. 2A	Serious eye damage/eye irritation Category 2A
Flam. Liq. 2	Flammable liquids Category 2
Flam. Liq. 3	Flammable liquids Category 3
Repr. 2	Reproductive toxicity Category 2
Skin Irrit. 2	Skin corrosion/irritation Category 2
Skin Sens. 1	Skin sensitization Category 1
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H225	Highly flammable liquid and vapor
H226	Flammable liquid and vapor
H302	Harmful if swallowed
H315	Causes skin irritation
H317	May cause an allergic skin reaction
H318	Causes serious eye damage
H319	Causes serious eye irritation
H336	May cause drowsiness or dizziness
H361	Suspected of damaging fertility or the unborn child
H412	Harmful to aquatic life with long lasting effects

Disclaimer

This document is generated for the purpose of distributing health, safety, and environmental data. The information and recommendations are presented in good faith and believed to be from reliable sources, however, the information is provided without any warranty, expressed or implied, regarding its completeness or accuracy. Some information is from sources other than direct test data on the material itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and for this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of the product.

ALL NON-EMERGENCY QUESTIONS SHOULD BE DIRECTED TO CUSTOMER SERVICE (310) 632-7124

Revision date: 02/23/2015

Supersedes: 04/17/2013

Version: 1.0

TAB M

State of the Science of

Endocrine Disrupting Chemicals 2012

Summary for Decision-Makers

Edited by
Åke Bergman
Jerrold J. Heindel
Susan Jobling
Karen A. Kidd
R. Thomas Zoeller

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC Participating Organizations.

The Inter-Organisation Programme for the Sound Management of Chemicals (IOMC) was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The Participating Organisations are FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organisations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

WHO Library Cataloguing-in-Publication Data

State of the science of endocrine disrupting chemicals 2012 / edited by Åke Bergman, Jerrold J. Heindel, Susan Jobling, Karen A. Kidd and R. Thomas Zoeller.

1.Endocrine disruptors. 2.Environmental exposure. 3.Animals, Wild. 4.Endocrine system. 5.Hormone Antagonists I.Bergman, Åke. II.Heindel, Jerrold J. III.Jobling, Susan. IV.Kidd, Karen. V.Zoeller, R. Thomas. VI.World Health Organization. VII.United Nations Environment Programme. VIII.Inter-Organization Programme for the Sound Management of Chemicals.

© United Nations Environment Programme and the World Health Organization, 2013

This Summary Report (UNEP job number: DTI/1554/GE) is based on the main report “State of the Science of Endocrine Disrupting Chemicals - 2012” ISBN: 978-92-807-3274-0 (UNEP) and 978 92 4 150503 1 (WHO) (NLM classification: WK 102).

All rights reserved.

This publication can be obtained from the United Nations Environment Programme (UNEP) (e-mail: unep.tie@unep.org) or from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int). Requests for permission to reproduce or translate this publication – whether for sale or for noncommercial distribution – should be addressed to UNEP (e-mail: unep.tie@unep.org) or to WHO Press, at the above address (fax: +41 22 791 4806; e-mail: permissions@who.int).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of UNEP or WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by UNEP or WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters. All reasonable precautions have been taken by UNEP or WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall UNEP or WHO be liable for damages arising from its use.

This document is not a formal publication of the United Nations Environment Programme and the World Health Organization and the views expressed therein are the collective views of the international experts participating in the working group and are not necessarily the views of the organizations.

UNEP promotes environmentally sound practices globally and in its own activities. This publication is printed on 100% recycled paper, using vegetable - based inks and other eco-friendly practices. Our distribution policy aims to reduce UNEP's carbon footprint.

State of the Science of

Endocrine Disrupting Chemicals 2012

Summary for Decision-Makers

An assessment of the state
of the science of endocrine disruptors
prepared by a group of experts
for the United Nations Environment Programme
and World Health Organization.

Edited by
Åke Bergman
Jerrold J. Heindel
Susan Jobling
Karen A. Kidd
R. Thomas Zoeller



1972-2012:
Serving People
and the Planet

Contents

Preface	v
1. Introduction	1
2. Key concerns	2
3. Endocrine systems and endocrine disruption	4
4. Endocrine disruptors and human health	7
5. Why should we be concerned?—Human disease trends	8
6. Endocrine disruptors and wildlife health	10
7. Why should we be concerned?—Population effects in wildlife	11
8. Sensitive periods for endocrine disruptor action—Windows of exposure	12
9. Occurrence of and exposures to endocrine disruptors	14
10. The tip of the iceberg	18
11. Testing for EDCs	19
12. Lessons from the past	20
13. Main conclusions and advances in knowledge since 2002	22
14. Concluding remarks	27
15. References	29

Preface

This *Summary for Decision-Makers*, together with the main document, *State of the Science of Endocrine Disrupting Chemicals—2012*, presents information and key concerns for policy-makers on endocrine disruptors as part of the ongoing collaboration between the World Health Organization (WHO) and the United Nations Environment Programme (UNEP) to address concerns about the potential adverse health effects of chemicals on humans and wildlife. The main messages from the three chapters of the main document are presented as well.

We live in a world in which man-made chemicals have become a part of everyday life. It is clear that some of these chemical pollutants can affect the endocrine (hormonal) system, and certain of these endocrine disruptors may also interfere with the developmental processes of humans and wildlife species. Following international recommendations in 1997 by the Intergovernmental Forum on Chemical Safety and the Environment Leaders of the Eight regarding the issue of endocrine disrupting chemicals (EDCs), WHO, through the International Programme on Chemical Safety (IPCS), a joint programme of WHO, UNEP and the International Labour Organization, developed in 2002 a report entitled *Global Assessment of the State-of-the-Science of Endocrine Disruptors*.

The Strategic Approach to International Chemicals Management (SAICM) was established by the International Conference on Chemicals Management (ICCM) in February 2006, with the overall objective to achieve the sound management of chemicals throughout their life cycle so that, by 2020, chemicals are used and produced in ways that minimize significant adverse effects on human health and the environment.

SAICM recognizes that risk reduction measures need to be improved to prevent the adverse effects of chemicals on the health of children, pregnant women, fertile populations, the elderly, the poor, workers and other vulnerable groups and susceptible environments. It states that one measure to safeguard the health of women and children is the minimization of chemical exposures before conception and through gestation, infancy, childhood and adolescence.

SAICM also specifies that groups of chemicals that might be prioritized for assessment and related studies, such as for the development and use of safe and effective alternatives, include chemicals that adversely affect, inter alia, the reproductive, endocrine, immune or nervous systems. A resolution to include EDCs as an emerging issue under SAICM was adopted in September 2012 by ICCM at its third session.

EDCs represent a challenge, as their effects depend on both the level and timing of exposure, being especially critical when exposure occurs during development. They have diverse applications, such as pesticides, flame retardants in different products, plastic additives and cosmetics, which may result

in residues or contaminants in food and other products. Therefore, EDCs may be released from the products that contain them.

The protection of the most vulnerable populations from environmental threats is a key component of the Millennium Development Goals. As the challenge in meeting the existing goals increases, with work under way in developing countries to overcome traditional environmental threats while dealing with poverty, malnutrition and infectious disease, emerging issues should be prevented from becoming future traditional environmental threats. Endocrine disruption is a challenge that must continue to be addressed in ways that take into account advances in our knowledge.

UNEP and WHO, in collaboration with a working group of international experts, are taking a step forward by developing these documents on endocrine disruptors, including scientific information on their impacts on human and wildlife health and key concerns for decision-makers and others concerned. The well-being of future human and wildlife generations depends on safe environments.

From late 2010 until mid-2012, the working group developed, contributed to and revised sections of the main document during three separate meetings, as well as through teleconferences. Professor Åke Bergman led the working group and facilitated the development of this summary with the editors in coordination with the working group, UNEP and WHO.

The following international scientific experts were part of the working group that developed the documents:

- Georg Becher, Norwegian Institute of Public Health, Norway
- Åke Bergman, Stockholm University, Sweden (Leader)
- Poul Bjerregaard, University of Southern Denmark, Denmark
- Riana Bornman, Pretoria Academic Hospital, South Africa
- Ingvar Brandt, Uppsala University, Sweden
- Jerrold J. Heindel, National Institute of Environmental Health Sciences, USA
- Taisen Iguchi, National Institutes of Natural Sciences, Okazaki, Japan
- Susan Jobling, Brunel University, England
- Karen A. Kidd, University of New Brunswick, Canada
- Andreas Kortenkamp, University of London and Brunel University, England
- Derek C.G. Muir, Environment Canada, Canada

- Roseline Ochieng, Aga Khan University Hospital, Kenya
- Niels Erik Skakkebaek, University of Copenhagen, Denmark
- Jorma Toppari, University of Turku, Finland
- Tracey J. Woodruff, University of California at San Francisco, USA
- R. Thomas Zoeller, University of Massachusetts, USA

The UNEP/WHO Secretariat for this project included:

- Marie-Noel Bruné Drisse, Department of Public Health and Environment, World Health Organization, Geneva, Switzerland
- Carlos Dora, Department of Public Health and Environment, World Health Organization, Geneva, Switzerland
- Ruth A. Etzel, Department of Public Health and Environment, World Health Organization, Geneva, Switzerland
- Agneta Sundén Byléhn, Division of Technology, Industry and Economics, Chemicals Branch, United Nations Environment Programme, Geneva, Switzerland
- Simona Surdu, Department of Public Health and Environment, World Health Organization, Geneva, Switzerland

Editorial assistance was provided by Susan Jobling, and reference processing was performed by Ioannis Athanassiadis, Åke Bergman and Hans von Stedingk. Further editorial assistance was provided by Kathy Prout (WHO) and Marla Sheffer. John Bellamy assisted with the design of drawings and

figures and the layout of the two documents. Nida Besbelli, consultant to the UNEP Secretariat, provided organizational support and assisted with the finalization of references, tables, and lists of abbreviations and species. A list of chemicals, including abbreviations/common names and Chemical Abstracts Service registry numbers, was provided by Derek C.G. Muir and Åke Bergman. A list of species discussed in the summary and main documents was prepared by Nida Besbelli, Åke Bergman, Poul Bjerregaard and Susan Jobling. Further contributions and reviews were received from Heli Bathija (WHO), Timothy J. Kasten (UNEP), Desiree Montecillo Narvaez (UNEP), Maria Neira (WHO) and Sheryl Vanderpoel (WHO).

The working group members, scientific experts and contributors of text served as individual scientists and not as representatives of any organization, government or industry. All individuals who participated in the preparation of these documents served in their personal capacity and were required to sign a Declaration of Interest statement informing the Responsible Officer if, at any time, there was a conflict of interest perceived in their work. Such a procedure was followed, and no conflicts of interest were identified.

The development and publication of the two documents were supported by funds provided to UNEP by the Norwegian government, the Swedish Environment Ministry, the Swedish Research Council (FORMAS) and the Swedish Environmental Protection Agency. Further support was provided to WHO by the United States National Institute of Environmental Health Sciences (NIEHS) through cooperative agreement 1 U01 ES02617. The contents of the documents are solely the responsibility of the contributors and do not necessarily represent the official views of the NIEHS.

1. Introduction

This document presents summary information and key concerns for decision-makers on endocrine disrupting chemicals (EDCs) from the full report entitled *State of the Science of Endocrine Disrupting Chemicals—2012*. It is part of the ongoing collaboration between the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) to address concerns about the potential adverse effects of anthropogenic chemicals.

We live in a world in which man-made chemicals have become a part of everyday life. Some of these chemical pollutants can affect the endocrine (hormonal) system and interfere with important developmental processes in humans and wildlife.

Following international recommendations in 1997 by the Intergovernmental Forum on Chemical Safety and the Environment Leaders of the Eight regarding the issue of EDCs, the International Programme on Chemical Safety (IPCS), a joint programme of WHO, UNEP and the International Labour Organization, developed in 2002 a report entitled *Global Assessment of the State-of-the-Science of Endocrine Disruptors* (**Figure 1**) (IPCS, 2002).

The general conclusions from this work were that

although it is clear that certain environmental chemicals can interfere with normal hormonal processes, there is weak evidence that human health has been adversely affected by exposure to endocrine-active chemicals. However, there is sufficient evidence to conclude that adverse endocrine-mediated effects have occurred in some wildlife species. Laboratory studies support these conclusions.

The IPCS (2002) document further concluded that there was a need for broad, collaborative and international research initiatives and presented a list of research needs.

Since 2002, intensive scientific work has improved our understanding of the impacts of EDCs on human and wildlife health. Recent scientific reviews and reports published by the Endocrine Society (Diamanti-Kandarakis et al., 2009), the European Commission (Kortenkamp et al., 2011) and the European Environment Agency (2012) illustrate the scientific interest in and complexity of this issue. These documents concluded that there is emerging evidence for adverse reproductive outcomes (infertility, cancers, malformations) from

exposure to EDCs, and there is also mounting evidence for effects of these chemicals on thyroid function, brain function, obesity and metabolism, and insulin and glucose homeostasis.

The Endocrine Society called for timely action to prevent harm (Diamanti-Kandarakis et al., 2009), and the European Society for Paediatric Endocrinology and the Pediatric Endocrine Society, based in the United States of America (USA), put forward a consensus statement calling for action regarding endocrine disruptors and their effects (Skakkebaek et al., 2011).

In 2012, UNEP and WHO, in collaboration with international experts, have taken a step forward by supporting the development of a main document on endocrine disruptors, including scientific information on their impacts on human and wildlife health, scientific developments over the decade since publication of the IPCS (2002) report and key concerns. The collaboration also included the development of the present summary report, which is aimed at decision-makers and others concerned about the future of human and wildlife health. The key concerns and main messages from the three chapters of the main document are also presented in this summary.

The main document provides an assessment of the strength of the evidence supporting the hypothesis that chemicals with endocrine activity are a causal factor in the manifestation of specific conditions.

The *State of the Science of Endocrine Disrupting Chemicals—2012* report starts by explaining what endocrine disruption is all about and then reviews our current knowledge of endocrine disrupting effects in humans and in wildlife. The document ends with a review of sources of and exposures to EDCs. The present *Summary for Decision-Makers* refers to the detailed information, including references, given in the main report (UNEP/WHO, 2012).

Figure 1. The *Global Assessment of the State-of-the-Science of Endocrine Disruptors* report, as published by IPCS in 2002.



2. Key concerns

- Human and wildlife health depends on the ability to reproduce and develop normally. This is not possible without a healthy endocrine system.
- Three strands of evidence fuel concerns over endocrine disruptors:
 - The high incidence and the increasing trends of many endocrine-related disorders in humans;
 - Observations of endocrine-related effects in wildlife populations;
 - The identification of chemicals with endocrine disrupting properties linked to disease outcomes in laboratory studies.
- Many endocrine-related diseases and disorders are on the rise.
 - Large proportions (up to 40%) of young men in some countries have low semen quality, which reduces their ability to father children.
 - The incidence of genital malformations, such as non-descending testes (cryptorchidisms) and penile malformations (hypospadias), in baby boys has increased over time or levelled off at unfavourably high rates.
 - The incidence of adverse pregnancy outcomes, such as preterm birth and low birth weight, has increased in many countries.
 - Neurobehavioural disorders associated with thyroid disruption affect a high proportion of children in some countries and have increased over past decades.
 - Global rates of endocrine-related cancers (breast, endometrial, ovarian, prostate, testicular and thyroid) have been increasing over the past 40–50 years.
 - There is a trend towards earlier onset of breast development in young girls in all countries where this has been studied. This is a risk factor for breast cancer.
 - The prevalence of obesity and type 2 diabetes has dramatically increased worldwide over the last 40 years. WHO estimates that 1.5 billion adults worldwide are overweight or obese and that the number with type 2 diabetes increased from 153 million to 347 million between 1980 and 2008.
- Close to 800 chemicals are known or suspected to be capable of interfering with hormone receptors, hormone synthesis or hormone conversion. However, only a small fraction of these chemicals have been investigated in tests capable of identifying overt endocrine effects in intact organisms.
 - The vast majority of chemicals in current commercial use have not been tested at all.
 - This lack of data introduces significant uncertainties about the true extent of risks from chemicals that potentially could disrupt the endocrine system.
- Human and wildlife populations all over the world are exposed to EDCs.
 - There is global transport of many known and potential EDCs through natural processes as well as through commerce, leading to worldwide exposure.
 - Unlike 10 years ago, we now know that humans and wildlife are exposed to far more EDCs than just those that are persistent organic pollutants (POPs).
 - Levels of some newer POPs in humans and wildlife are still increasing, and there is also exposure to less persistent and less bioaccumulative, but ubiquitous, chemicals.
 - New sources of human exposure to EDCs and potential EDCs, in addition to food and drinking-water, have been identified.
 - Children can have higher exposures to chemicals compared with adults—for example, through their hand-to-mouth activity and higher metabolic rate.
- The speed with which the increases in disease incidence have occurred in recent decades rules out genetic factors as the sole plausible explanation. Environmental and other non-genetic factors, including nutrition, age of mother, viral diseases and chemical exposures, are also at play, but are difficult to identify. Despite these difficulties, some associations have become apparent:
 - Non-descended testes in young boys are linked with exposure to diethylstilbestrol (DES) and polybrominated diphenyl ethers (PBDEs) and with occupational pesticide exposure during pregnancy. Recent evidence also shows links with the painkiller paracetamol. However, there is little to suggest that polychlorinated biphenyls (PCBs) or dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyltrichloroethane (DDT) are associated with cryptorchidism.
 - High exposures to polychlorinated dioxins and certain PCBs (in women who lack some detoxifying enzymes) are risk factors in breast cancer. Although exposure to natural and synthetic estrogens is associated with breast cancer, similar evidence linking estrogenic environmental chemicals with the disease is not available.
 - Prostate cancer risks are related to occupational exposures to pesticides (of an unidentified nature), to some PCBs and to arsenic. Cadmium exposure has been linked with prostate cancer in some, but not all, epidemiological studies, although the associations are weak.

- Developmental neurotoxicity with negative impacts on brain development is linked with PCBs. Attention deficit/hyperactivity disorder (ADHD) is overrepresented in populations with elevated exposure to organophosphate pesticides. Other chemicals have not been investigated.
- An excess risk of thyroid cancer was observed among pesticide applicators and their wives, although the nature of the pesticides involved was not defined.
- **Significant knowledge gaps exist as to associations between exposures to EDCs and other endocrine diseases, as follows:**
 - There is very little epidemiological evidence to link EDC exposure with adverse pregnancy outcomes, early onset of breast development, obesity or diabetes.
 - There is almost no information about associations between EDC exposure and endometrial or ovarian cancer.
 - High accidental exposures to PCBs during fetal development or to dioxins in childhood increase the risk of reduced semen quality in adulthood. With the exception of these studies, there are no data sets that include information about fetal EDC exposures and adult measures of semen quality.
 - No studies exist that explore the potential link between fetal exposure to EDCs and the risk of testicular cancer occurring 20–40 years later.
- **Numerous laboratory studies support the idea that chemical exposures contribute to endocrine disorders in humans and wildlife. The most sensitive window of exposure to EDCs is during critical periods of development, such as during fetal development and puberty.**
 - Developmental exposures can cause changes that, while not evident as birth defects, can induce permanent changes that lead to increased incidence of diseases throughout life.
 - These insights from endocrine disruptor research in animals have an impact on current practice in toxicological testing and screening. Instead of solely studying effects of exposures in adulthood, the effects of exposures during sensitive windows in fetal development, perinatal life, childhood and puberty require careful scrutiny.
- **Worldwide, there has been a failure to adequately address the underlying environmental causes of trends in endocrine diseases and disorders.**
 - Health-care systems do not have mechanisms in place to address the contribution of environmental risk factors to endocrine disorders. The benefits that can be reaped by adopting primary preventive measures for dealing with these diseases and disorders have remained largely unrealized.
- **Wildlife populations have been affected by endocrine disruption, with negative impacts on growth and reproduction. These effects are widespread and have been due primarily to POPs. Bans of these chemicals have reduced exposure and led to recovery of some populations.**
 - It is therefore plausible that additional EDCs, which have been increasing in the environment and are of recent concern, are contributing to current population declines in wildlife species. Wildlife populations that are also challenged by other environmental stressors are particularly vulnerable to EDC exposures.
- **Internationally agreed and validated test methods for the identification of endocrine disruptors capture only a limited range of the known spectrum of endocrine disrupting effects. This increases the likelihood that harmful effects in humans and wildlife are being overlooked.**
 - For many endocrine disrupting effects, agreed and validated test methods do not exist, although scientific tools and laboratory methods are available.
 - For a large range of human health effects, such as female reproductive disorders and hormonal cancers, there are no viable laboratory models. This seriously hampers progress in understanding the full scale of risks.
- **Disease risk due to EDCs may be significantly underestimated.**
 - A focus on linking one EDC to one disease severely underestimates the disease risk from mixtures of EDCs. We know that humans and wildlife are simultaneously exposed to many EDCs; thus, the measurement of the linkage between exposure to mixtures of EDCs and disease or dysfunction is more physiologically relevant. In addition, it is likely that exposure to a single EDC may cause disease syndromes or multiple diseases, an area that has not been adequately studied.
- **An important focus should be on reducing exposures by a variety of mechanisms. Government actions to reduce exposures, while limited, have proven to be effective in specific cases (e.g. bans and restrictions on lead, chlorpyrifos, tributyltin, PCBs and some other POPs). This has contributed to decreases in the frequency of disorders in humans and wildlife.**
- **Despite substantial advances in our understanding of EDCs, uncertainties and knowledge gaps still exist that are too important to ignore. These knowledge gaps hamper progress towards better protection of the public and wildlife. An integrated, coordinated international effort is needed to define the role of EDCs in current declines in human and wildlife health and in wildlife populations.**

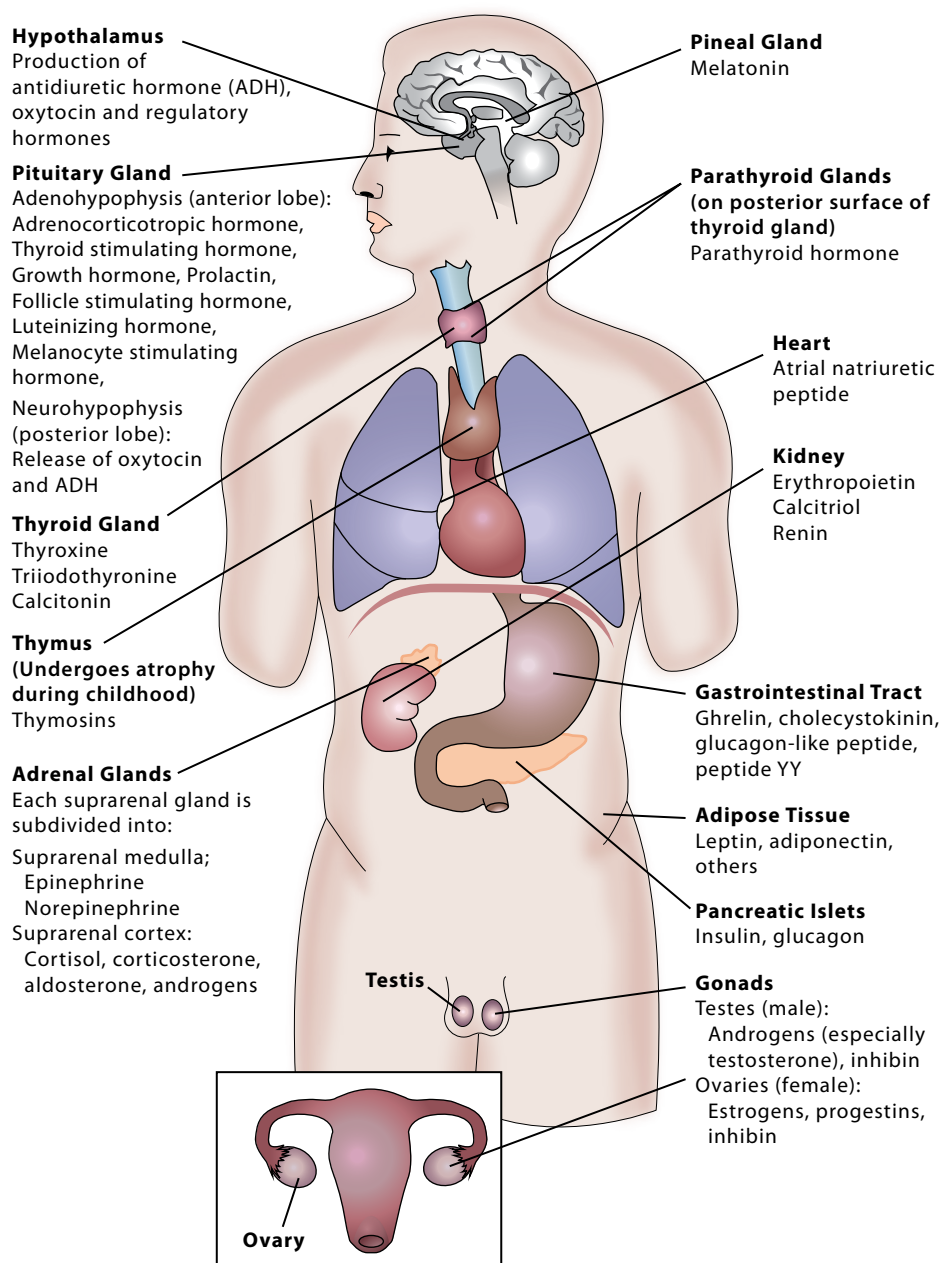
3. Endocrine systems and endocrine disruption

For the purposes of this report, we have adopted the definition of an endocrine disruptor that was used in the IPCS (2002) document on endocrine disruptors (see textbox). Simplified, this means that endocrine disruptors are chemicals, or chemical mixtures, that interfere with normal hormone action.

To understand endocrine disruption, we must understand the basic features of the endocrine system, which consists of many interacting tissues that talk to each other and the rest of the body using signalling mediated by molecules called hormones. The human endocrine system is visualized in **Figure 2**. It is responsible for controlling a large number of processes in the body, including early processes, such as cell

differentiation during development and organ formation, as well as most tissue and organ functions throughout adulthood (**Figure 3**). A hormone is a molecule produced by an endocrine gland that travels through the blood to produce effects on distant cells and tissues via integrated complex interacting signalling pathways usually involving hormone receptors. There are over 50 different hormones and hormone-related molecules (cytokines and neurotransmitters) in humans that integrate and control normal body functions across and between tissues and organs over the lifespan. This is also the case in wildlife. Hormones and their signalling pathways are critical to the normal functioning of every tissue and organ in both vertebrates and invertebrates and are often quite similar across species.

Figure 2. Overview of the endocrine system. Figure shows endocrine glands and some examples of hormones produced.



Definition of EDCs (IPCS, 2002)

"An endocrine disruptor is an exogenous substance or mixture that alters function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub) populations."

"A potential endocrine disruptor is an exogenous substance or mixture that possesses properties that might be expected to lead to endocrine disruption in an intact organism, or its progeny, or (sub) populations."

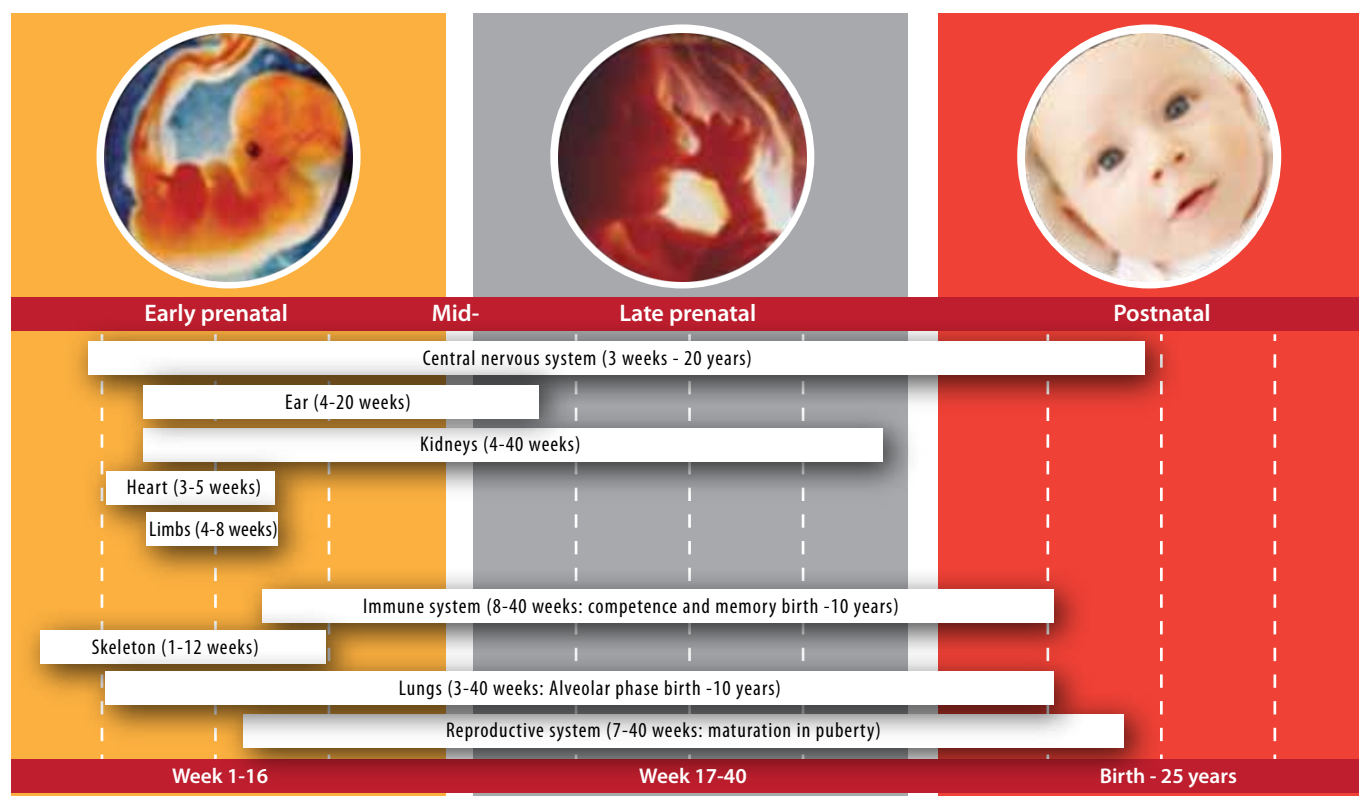


Figure 3. Sensitive windows of development. Each tissue has a specific window during development when it is forming. That is the sensitive window for effects of EDCs. Notice that some tissues continue developing after birth and into infancy and childhood, providing a longer window for exposures to affect programming.

Table 1. Comparison of hormone and endocrine disruptor action.

Hormones	Endocrine disruptors
Act via hormone receptors <ul style="list-style-type: none"> – Some have multiple receptors – Tissue-specific receptor classes and subtypes – Hormones normally bind similarly to all receptor subtypes 	Some act via hormone receptors and multiple receptors <ul style="list-style-type: none"> – Will cause abnormal receptor function – Likely isoform-specific interactions
Active at low doses <ul style="list-style-type: none"> – Blood levels do not always reflect activity – May be bound to serum proteins in blood with a small percentage free – No bioaccumulation 	Some act at low doses, others variable <ul style="list-style-type: none"> – Blood levels do not always reflect activity – May be bound to serum proteins – Effects on hormone blood levels may not reflect on hormone action – Possible bioaccumulation
Non-linear dose–response relationships <ul style="list-style-type: none"> – Always saturable with variable dynamic range – Can exhibit non-monotonic dose–response relationships – High-dose effects not same as low-dose effects 	Non-linear dose–response relationships <ul style="list-style-type: none"> – Always saturable with variable dynamic range – Can exhibit non-monotonic dose–response relationships – High-dose effects not same as low-dose effects
Tissue-specific and life stage–specific effects	Tissue-specific and life stage–specific effects
Developmental effects permanent <ul style="list-style-type: none"> – Programmes brain and endocrine system for adult function 	Developmental effects permanent <ul style="list-style-type: none"> – Interferes with programming processes
Different end-points vary in sensitivity	Different end-points vary in sensitivity

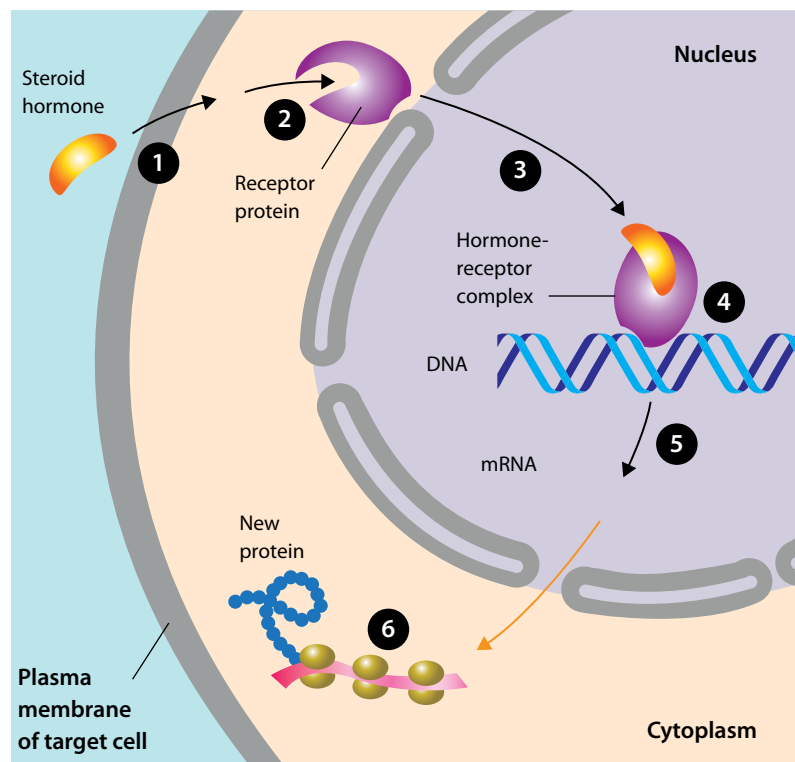


Figure 4. Example of hormone action. Many hormones act via binding to specific receptors (2) to stimulate the synthesis of new proteins (6), which then control tissue function. Some hormones also act via receptors on the membrane; in that case, the actions are more immediate in nature.

Endocrine disruptors are chemicals that interfere in some way with hormone action and in so doing can alter endocrine function such that it leads to adverse effects on human and wildlife health.

The diverse systems affected by EDCs likely include all hormonal systems and range from those controlling the development and function of reproductive organs to the tissues and organs regulating metabolism and satiety. Effects on these systems can lead to obesity, infertility or reduced fertility, learning and memory difficulties, adult-onset diabetes or cardiovascular disease, as well as a variety of other diseases. We have only recently understood that EDCs can affect the systems that control fat development and weight gain. This is a good example of complex physiological

systems that are influenced by EDCs that were not known just a few years ago. Generally, there are two pathways by which a chemical could disrupt hormone action: a direct action on a hormone–receptor protein complex or a direct action on a specific protein that controls some aspect of hormone delivery to the right place at the right time (**Figure 3**). EDCs exhibit the same characteristics as hormones (**Table 1**), and they can often interfere with all processes controlled by hormones. The affinity of an endocrine disruptor for a hormone receptor is not equivalent to its potency. Chemical potency on a hormone system is dependent upon many factors.

Thus, EDCs act like hormones. Like hormones, which act via binding to receptors (**Figure 4**) at very low concentrations, EDCs have the ability to be active at low concentrations, many in the range of current human and wildlife exposures. EDCs can exert effects on more than estrogen, androgen and thyroid hormone action. Some are known to interact with multiple hormone receptors simultaneously. EDCs can work together to produce additive or synergistic effects not seen with the individual chemicals. EDCs also act on a variety of physiological processes in a tissue-specific manner and sometimes act via dose–response curves that are non-monotonic (non-linear). Indeed, as with hormones, it is often not possible to extrapolate low-dose effects from the high-dose effects of EDCs. Timing of exposures is also critical, as exposures during development likely lead to irreversible effects, whereas the effects of adult exposures seem to go away when the EDC is removed. Sensitivity to endocrine disruption is highest during tissue development. It is important that these specific characteristics of EDCs be taken into account when the toxicity of a chemical with potential EDC activity is assessed.

4. Endocrine disruptors and human health

The data linking exposures to EDCs and human diseases are much stronger now than in 2002. Since human studies can show associations only, not cause and effect, it is important to use both human and animal data to develop the evidence for a link between exposures to EDCs and

human disease. Even so, it may never be possible to be absolutely certain that a specific exposure causes a specific disease or dysfunction due to the complexity of both exposures and disease etiology across the lifespan (**Figure 5**).

• Reproductive/endocrine

- Breast/prostate cancer
- Endometriosis
- Infertility
- Diabetes/metabolic syndrome
- Early puberty
- Obesity

• Immune/autoimmune

- Susceptibility to infections
- Autoimmune disease

• Cardiopulmonary

- Asthma
- Heart disease/hypertension
- Stroke

• Brain/nervous system

- Alzheimer disease
- Parkinson disease
- ADHD/learning disabilities

Figure 5. Diseases induced by exposure to EDCs during development in animal model and human studies.

Over the past 10 years, there has been a dramatic shift in focus from investigating associations between adult exposures to EDCs and disease outcomes to linking developmental exposures to disease outcomes later in life. This is now considered the most appropriate approach for most endocrine-related diseases and dysfunctions, based on data presented below (section 8). Children are the most vulnerable humans (**Figure 6**).

Together, the animal model data and human evidence support the idea that exposure to EDCs during fetal development and puberty plays a role in the increased incidences of reproductive diseases, endocrine-related cancers, behavioural and learning problems, including ADHD, infections, asthma, and perhaps obesity and diabetes in humans.

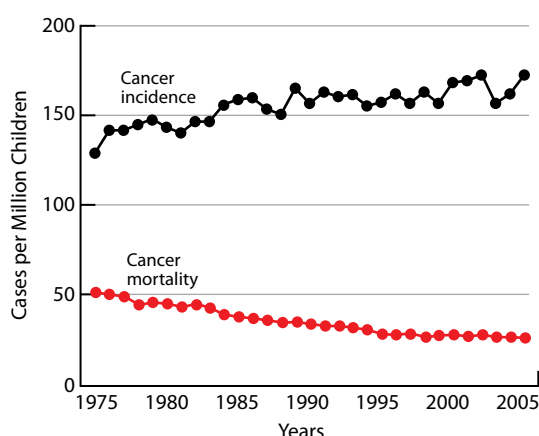


Figure 6. Children are among the most vulnerable humans. The figure shows cancer incidence and cancer mortality among children under 20 years of age in the USA (based on data from the United States National Cancer Institute's Surveillance, Epidemiology and End Results Program).

EXPOSURE TO EDCs COULD IMPAIR THE HEALTH OF OUR CHILDREN AND THEIR CHILDREN.

5. Why should we be concerned?—Human disease trends

- ◆ A significant increase in reproductive problems in some regions of the world over the last few decades points to a strong role for unidentified environmental factors in disease etiology.
- ◆ Incidences of endocrine cancers, illustrated by country or region in **Figures 7 and 8** for testicular cancer and breast cancer, respectively, have also increased during the same period.
- ◆ In certain parts of the world, there has been a significant decrease in human fertility rates, which occurred during one generation. There is also a notable rise in the use of assisted reproductive services.
- ◆ An increasing number of chemicals to which all humans in industrialized areas are exposed have been shown to interfere with hormone synthesis, action or metabolism.
- ◆ Experimental animal studies or studies with cells grown in culture have shown that many of these chemicals can also interfere with the development and function of mammalian endocrine systems.

In adults, EDC exposures have recently been linked with obesity (**Figure 9**), cardiovascular disease, diabetes and metabolic syndrome. Many of these diseases and disorders are increasing in incidence, some globally. The global health expenditure on diabetes alone was expected to a total of at least 376 billion USD in 2010 and rise to US\$ 490 billion in 2030—reaching 12% of all per capita health-care expenditures (Zhang et al., 2010).

Figure 7. Testicular cancer rates across northern Europe (from Richiardi et al., 2004; used with permission of the publisher).

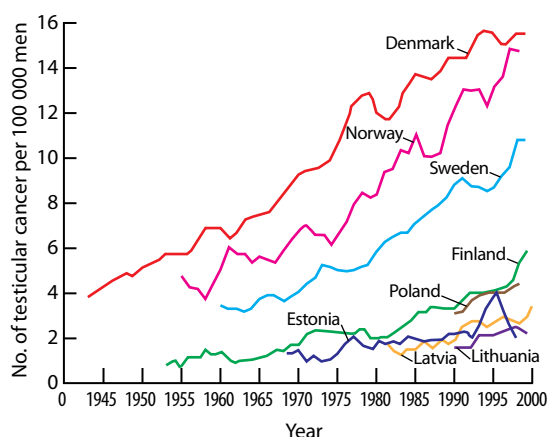
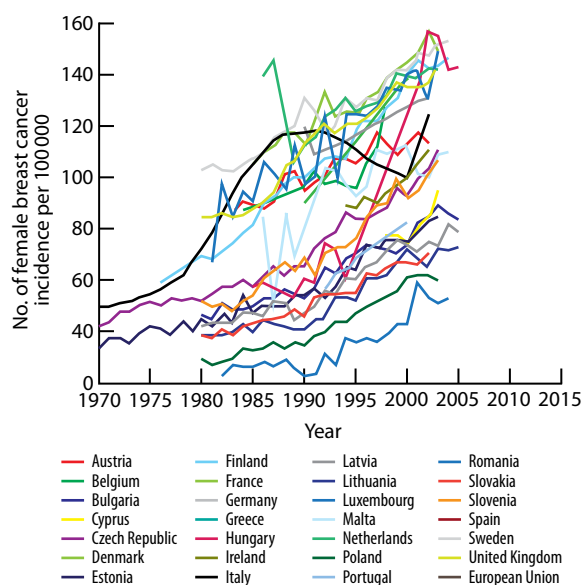


Figure 8. Female breast cancer incidence across Europe (data from <http://data.euro.who.int/hfad/>).



There are other trends of concern in human paediatric health. For example, some EDCs can interact with the thyroid system in animals and humans. Normal thyroid function is very important for normal brain development, particularly during pregnancy and after birth. EDC exposures have been linked with increased rates of neurobehavioural disorders, including dyslexia, mental retardation, ADHD and autism. In many countries, these types of disorder now affect 5–10% of babies born (http://www.medscape.org/viewarticle/547415_2); autism spectrum disorders now occur at a rate that approaches 1% (<http://www.cdc.gov/ncbddd/autism/addm.html>).

The prevalence of paediatric asthma has more than doubled over the past 20 years and is now the leading cause of child hospitalizations and school absenteeism. Certain birth defects, such as those of the male reproductive organs (e.g. failure of the testes to descend into the scrotum), are on the rise. The incidences of paediatric leukaemia and brain cancer have risen, as has the incidence of testicular cancer. These are stark health statistics. All of these complex non-communicable diseases have both a genetic and an environmental component, and, since the increases in incidence and prevalence cannot be due solely to genetics, it is important to focus on understanding

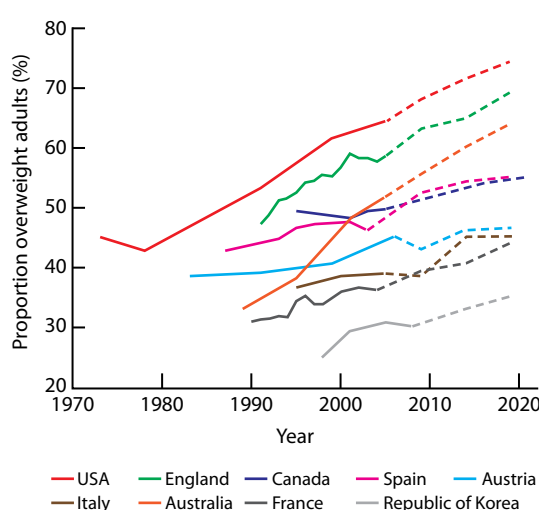


Figure 9. Past (solid lines) and projected (dashed lines) overweight rates in selected Organisation for Economic Co-operation and Development (OECD) countries.

the contribution of the environment to these chronic disease trends in humans.

It has been estimated that as much as 24% of human diseases and disorders are at least in part due to environmental factors (Prüss-Üstün & Corvalán, 2006). It is a challenge to identify these factors, but there is also a tremendous opportunity to improve human health by improving elements of the environment that have an impact on public health. The recognition of these challenges and opportunities, along with the fact that many of the most prevalent diseases are associated with the endocrine system, has led to a focus on EDCs.

6. Endocrine disruptors and wildlife health

Chemical exposures play a role in the deterioration of wildlife health, but understanding the role of EDCs in the global decline of populations or biodiversity is challenging. There are other natural or human-induced stressors that may confuse the picture. It is also difficult to obtain complete information about all chemicals present in the environment that might contribute to effects on wildlife. The best evidence that EDCs affect wildlife populations comes from long-term monitoring; for example, numbers of birds and molluscs are clearly increasing in regions where their exposures to chemicals (i.e. the pesticide DDT and the antifoulant tributyltin, respectively) have been reduced.

Figure 10. (right) Grey seal skull with highly eroded bone tissue associated with high POP concentrations during the 1970s and 1980s (photo by Hans Lind, used with permission).

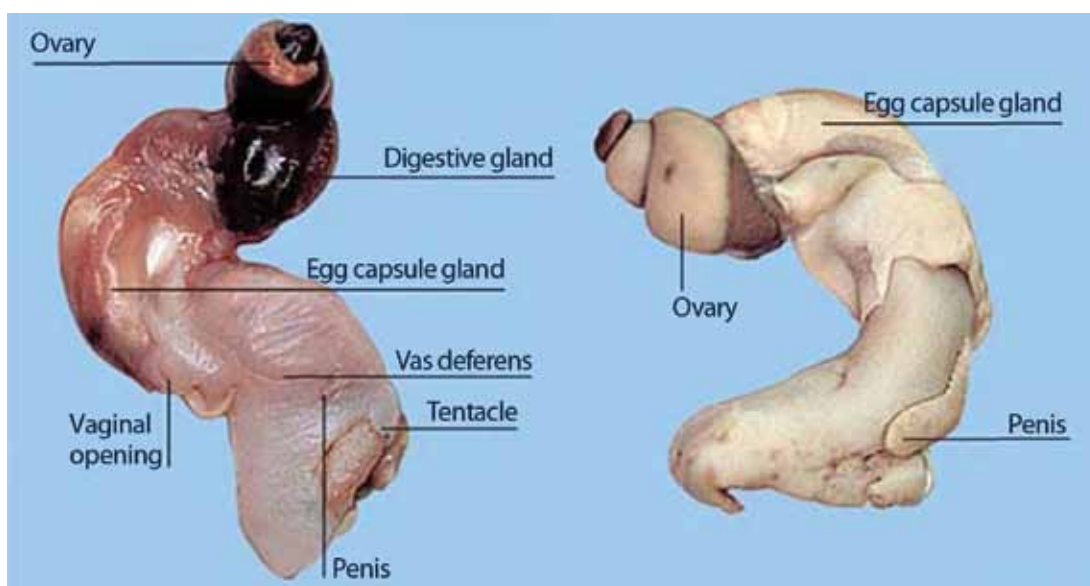
Endocrine system function and health have been compromised in wildlife species around the world. Studies of seals in the heavily polluted Baltic Sea found very high rates of female reproductive pathologies and reproductive failure in the 1970s and 1980s, which correlated with PCB contamination. Thanks to declines in PCB pollution, these effects are uncommon today. Disturbances of the normal functioning of the thyroid and of bone health have been traced to high POP levels in grey seals (**Figure 10**). In Dutch and Belgian colonies of common tern, eggs with higher concentrations of POPs took longer to hatch, and the chicks were smaller in size. Especially in the United Kingdom, but also in other countries, fish have been widely affected by estrogens and anti-androgens in municipal wastewaters. In male fish, increased levels of the female egg yolk proteins and the occurrence of eggs in the testes have been the consequence. The antifouling agent tributyltin in ship paints has disrupted mollusc sexual development worldwide (**Figure 11**). By the 1970s, many populations of



species, such as the commercially important oyster, had collapsed in heavily polluted areas. Reductions in use and exposure have led to a recovery of these populations.

There are important parallels between the increasing incidence of human disorders and those observed in wildlife. For example, testicular non-descent was observed in 68% of males in a population of black-tailed deer in Alaska, USA; similar trends were also observed in Montana, USA. There is recent evidence that animals living near humans also have increasing body weight. Moreover, studies of PCB-exposed wildlife have provided important information on exposure levels, early and subclinical effects and the clinical neurotoxicity of these chemicals. The mechanisms underlying the effects and the outcomes of exposures are often similar to those in humans.

Figure 11. Common whelk (*Buccinum undatum*) showing imposex (i.e. it has both male and female genitalia).



7. Why should we be concerned?—Population effects in wildlife

- ◆ There is a worldwide loss of species or reduced population numbers of amphibians, mammals, birds, reptiles, freshwater and marine fishes (**Figure 12**) and invertebrates.
- ◆ EDCs have been shown to negatively affect body systems that are critical for the health and survival of wildlife.
- ◆ The current body burdens of POPs such as PCBs, organochlorine pesticides and methylmercury in some fish-eating birds and marine mammal populations are at levels known to cause effects on breeding and on the immune system (**Figure 13**). Some of these populations are threatened or endangered.
- ◆ Legal, technical and ethical constraints to working with wildlife, notably those listed under endangered species legislation, prevent research to investigate chemical causes of population declines in these animals.
- ◆ An increasing number of chemicals to which wildlife are exposed have been shown to interfere with the hormonal and immune systems of wildlife species. Most of these chemicals are not monitored in ecosystems. Exposed wildlife populations are often not monitored either.
- ◆ Experimental animal studies have shown that many chemicals can interfere with the development and function of endocrine systems, leading to effects on behaviour, fecundity, growth, survival and disease resistance. This increases the probability that exposure to EDCs could lead to population-level effects in wildlife.

Subtle effects of EDCs on individual animals may result in devastating effects on wildlife populations over the long term. This is hard to prove until the declines in populations are evident, at which point it may be too late to save these species.

Exposures to EDCs affect the reproductive health of wildlife species, but there have been few studies translating these effects to impacts at the population level. Notwithstanding this, higher rates of reproductive problems are found in animals with higher exposure to EDCs than in

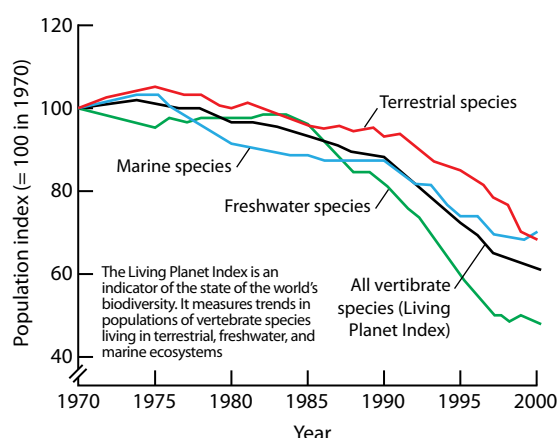


Figure 12. Population declines in wildlife (vertebrates) over 30 years, 1970–2000 (source: World Wide Fund for Nature [WWF] and the World Conservation Monitoring Centre of UNEP, used with permission).

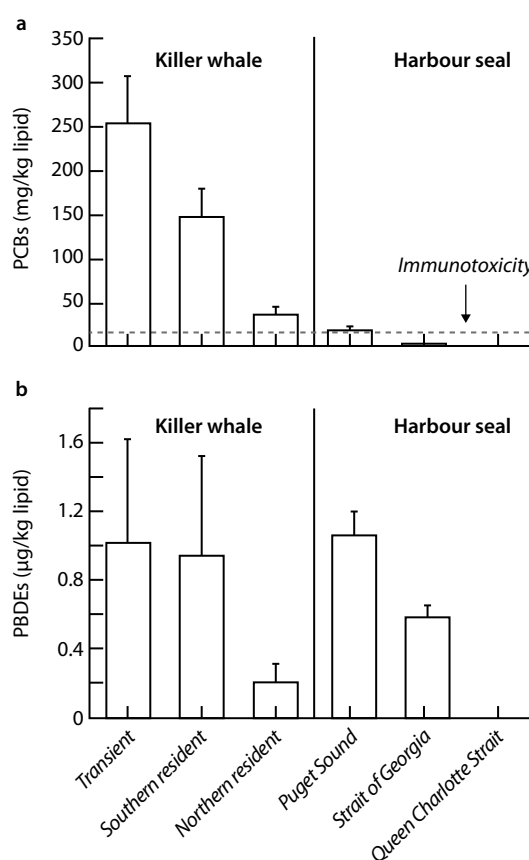


Figure 13. British Columbia's (Canada) killer whales (*Orcinus orca*) and harbour seals (*Phoca vitulina*) contain high levels of regulated PCBs and moderate levels of PBDEs. The figure was prepared using data from Krahn et al. (2007), Rayne et al. (2004) and Ross et al. (2000, 2012).

those exposed to lower concentrations. As levels of EDCs decline, some wildlife populations have shown recovery. EDCs have affected immune function, resulting in increased susceptibility to infectious diseases in vertebrates, notably marine mammals. Taken together, the evidence shows that exposure to endocrine disrupting contaminants plays a significant role in wildlife health trends.

WILDLIFE ACROSS THE GLOBE DISPLAY EDC-RELATED REPRODUCTIVE EFFECTS.

8. Sensitive periods for endocrine disruptor action—Windows of exposure

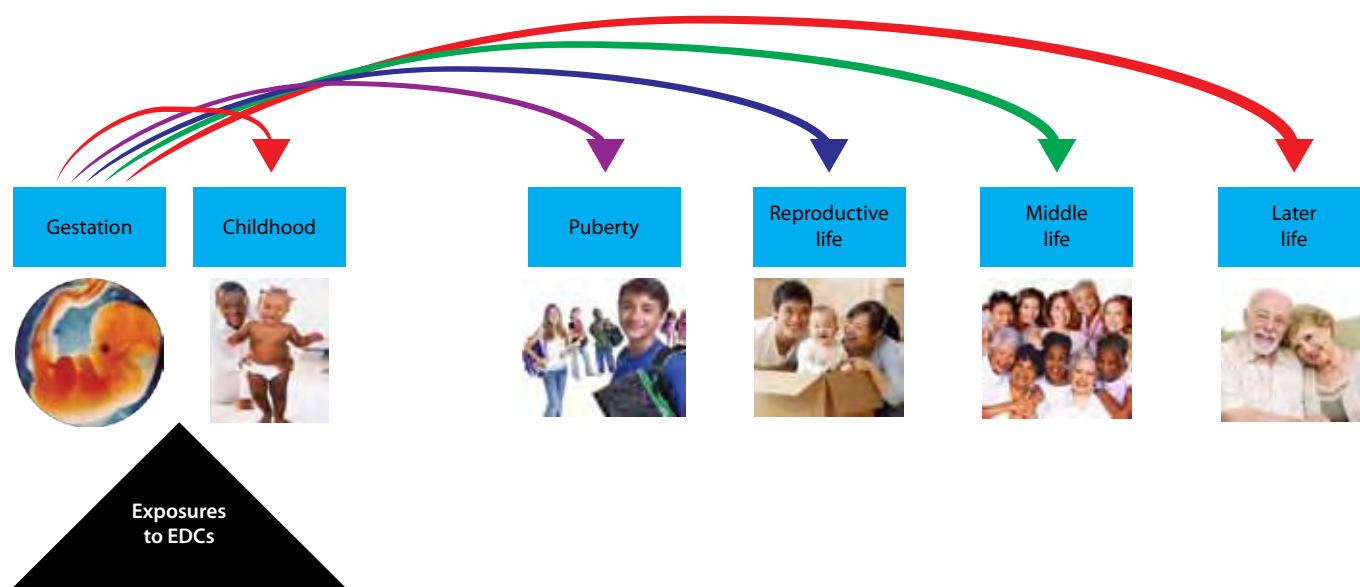
Hormones and EDCs that alter hormone actions can act at all times during life—fetal development, infancy, early childhood, puberty, adulthood and old age. The timing of hormone or EDC action often determines the strength of their impact. In the adult, the hormone or EDC has an effect when it is present, but when the hormone or EDC is withdrawn, the effect diminishes—much like insulin levels rising when blood sugar is high and then declining when blood sugar declines.

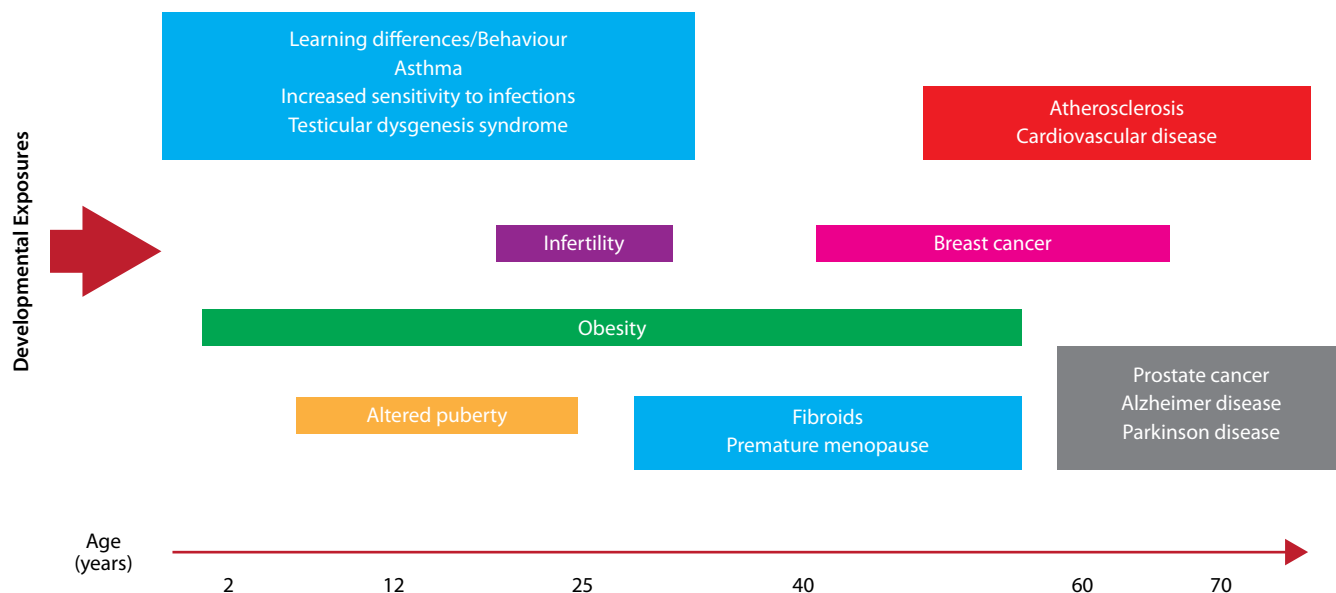
In contrast, exposure to hormones or EDCs during development (in utero and infancy and early childhood in humans) can have permanent effects if the exposure occurs during the period when a specific tissue is developing. These effects may only become visible decades later. This is called developmental programming. Hormones control the normal development of tissues from the fertilized sperm and egg to the fully developed fetus. Since some tissues continue developing after birth—such as the brain and reproductive system—the sensitive period for these tissues is extended, sometimes for decades after birth.

When a tissue is developing, it is more sensitive to the action of hormones and thus EDCs.

The mechanisms by which EDC exposure during development can alter the development of specific tissues, leading to increased susceptibility to diseases later in life, are just beginning to be understood. It is clear that hormones play an important role in cell differentiation, which leads to the development of tissues and organs. Once tissues and organs are fully developed and active, then hormones have a different role: to control the integration of signals between tissues and organ systems and to maintain normal function. Early development (when hormones are controlling cell changes to form tissues and organs) is thus a very sensitive time frame for EDC action. If an EDC is present during the developmental programming of a tissue, it could disrupt the normal hormone levels, leading to changes in tissue development—changes that would be stable across the lifetime and possibly confer sensitivity to disease later in life. These effects

Figure 14. The effects of early exposures to EDCs may be manifested any time in life.





are not likely to be evident at birth, but may show up only later in life, from a few months to decades later (**Figures 14 and 15**). These developmental effects emphasize that babies and children are not just little adults!

Some EDCs produce effects that can cross generations (transgenerational effects), such that exposure of a pregnant woman or wild

animal may affect not only the development of her offspring but also their offspring over several generations. This means that the increase in disease rates we are seeing today could in part be due to exposures of our grandparents to EDCs, and these effects could increase over each generation due to both transgenerational transmission of the altered programming and continued exposure across generations.

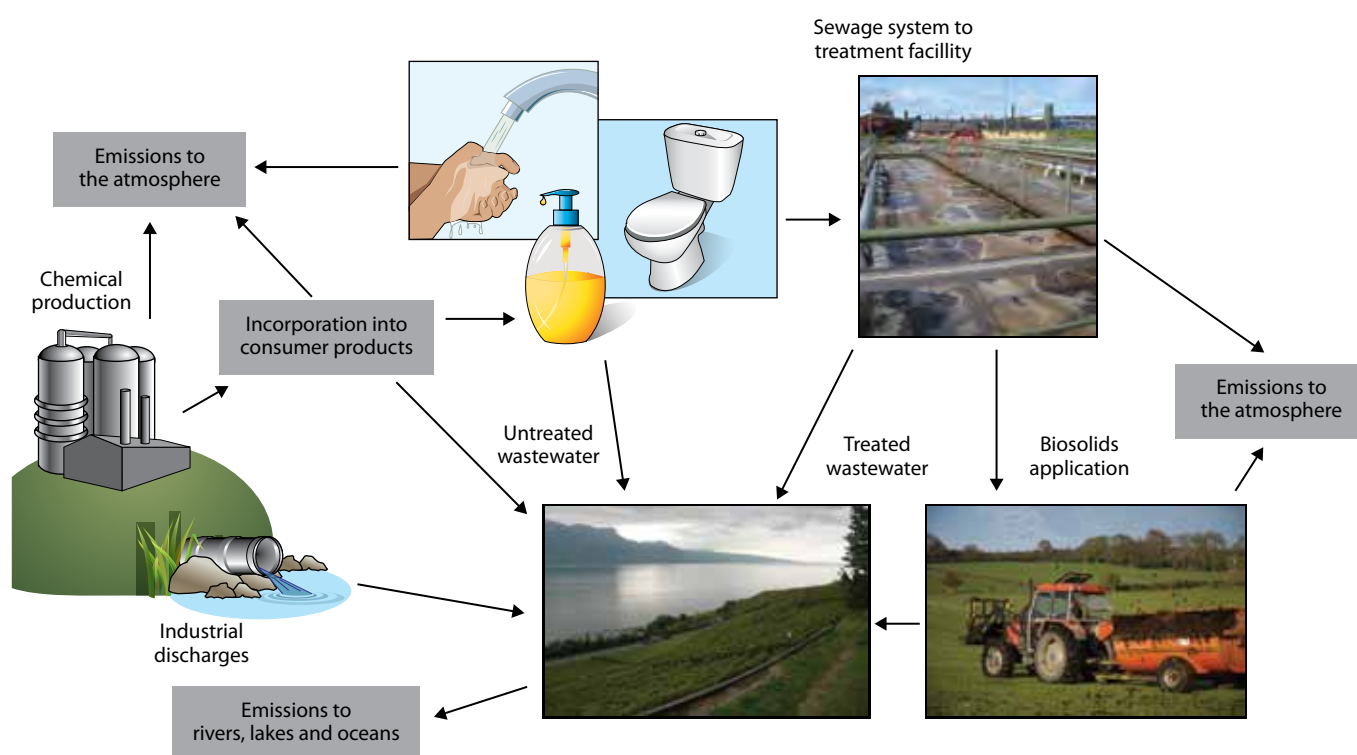
Figure 15. Examples of potential diseases and dysfunctions originating from early exposures to EDCs.

9. Occurrence of and exposures to endocrine disruptors

Since 2002, a large number of chemicals other than POPs have been identified as EDCs, and these include chemicals that have very different properties, sources and fates in the environment compared with POPs. EDCs are both man-made and natural. Some are found in a large variety of materials, products, articles and goods. They may also be by-products formed during manufacturing or combustion of wastes. These chemicals are also subjected to biological and environmental transformations that may form other EDCs. EDCs are found among many classes of chemicals, including POPs, current-use pesticides,

phytoestrogens, metals, active ingredients in pharmaceuticals, and additives or contaminants in food, personal care products, cosmetics, plastics, textiles and construction materials. Once released into the environment, the more persistent chemicals can be carried by air and water currents to remote locations, and many can be biomagnified through food webs to high levels in humans and other top predators. Other chemicals have shorter lifespans in the environment but are regularly released in effluents, in agricultural runoff or from urban environments, resulting in high environmental levels near the sources (**Figure 16**).

Figure 16. EDCs find their way into the environment via point and diffuse sources, as illustrated here.



Wildlife and humans are exposed to EDCs in several different ways. Air, water, soil, sediment and food are sources of EDCs for wildlife. Human exposure to EDCs occurs via ingestion of food, dust and water, via inhalation of gases and particles in the air and through dermal uptake (**Figure 17**). Transfer of EDCs from the pregnant female to the developing fetus through the placenta and to offspring in mothers' milk also occurs in both wildlife and humans. Children can have higher exposures to EDCs because of their hand-to-mouth activities. These multiple routes of exposure to a variety of EDCs mean that humans and wildlife are exposed to complex mixtures of EDCs. At this time, there are no data showing how exposure to mixtures of virtually hundreds of EDCs at low concentrations will affect human and

wildlife health. However, animal studies show that exposures to mixtures of EDCs produce additive effects. These additive effects occur even when each chemical is present at low levels not shown to produce effects individually. This means that many chemicals, each at levels without individual effect, could act together to cause health problems.

Several hundred environmental pollutants have been measured in humans and wildlife around the world, even in remote places such as the Arctic. Levels of EDCs in humans and wildlife vary with their location; some are higher in people and wildlife in urban or highly industrialized areas or sites where, for example, disposal of e-waste occurs, whereas others are higher in remote environments because of long-range

Figure 17. EDCs from multiple sources can be taken up by humans by several routes, entering the body via ingestion, inhalation and skin uptake.



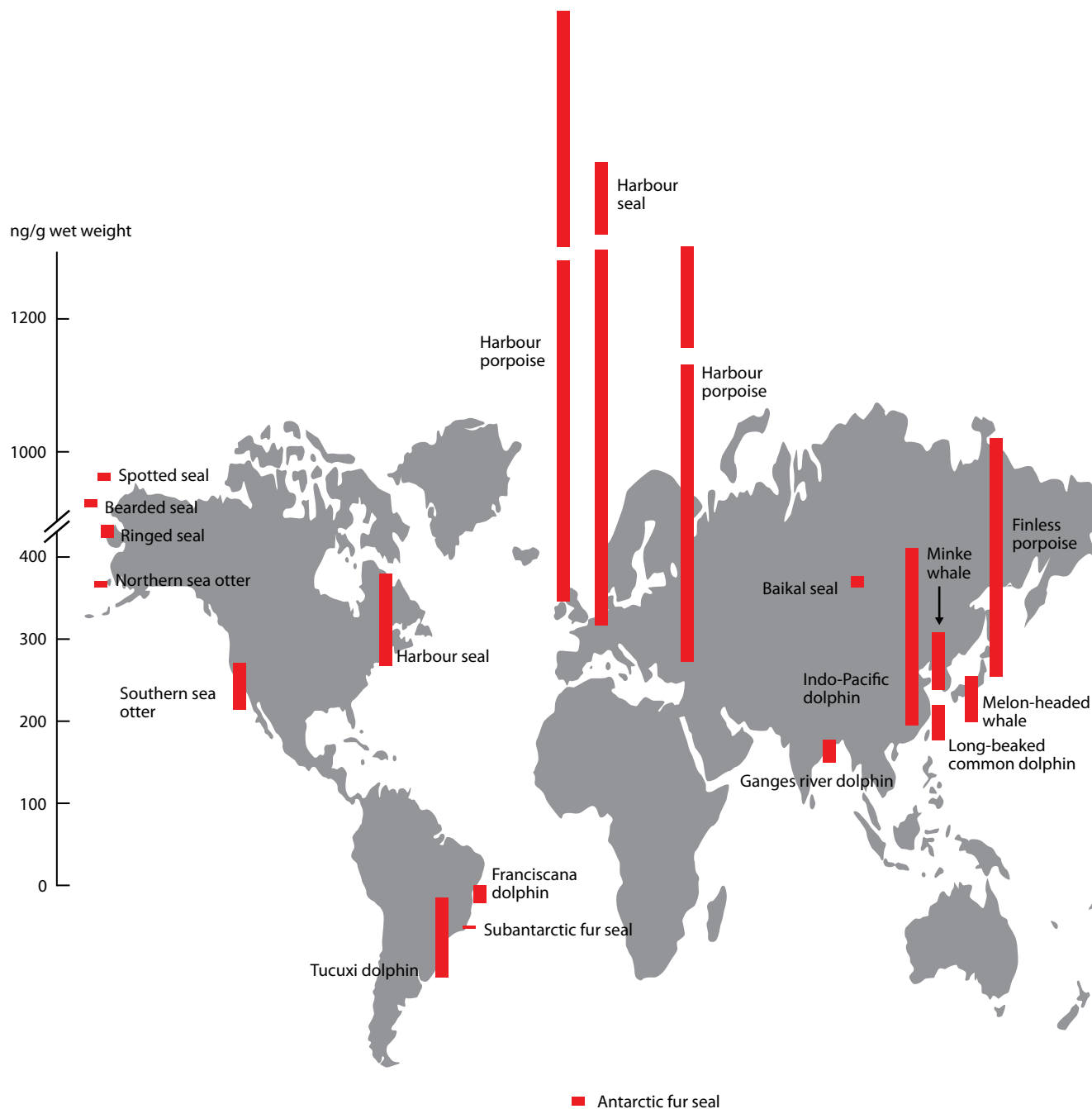
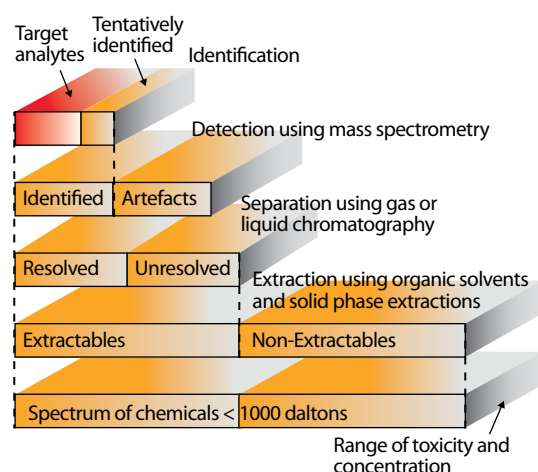
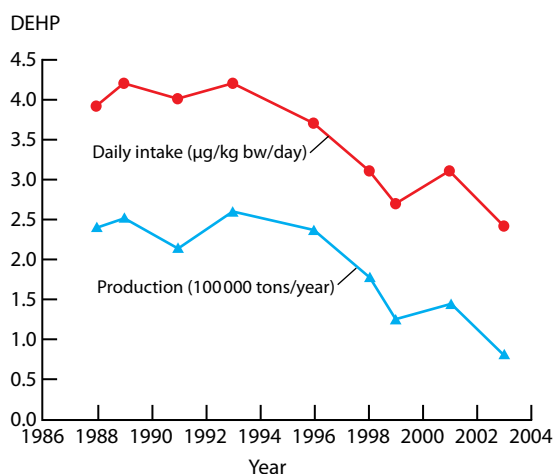
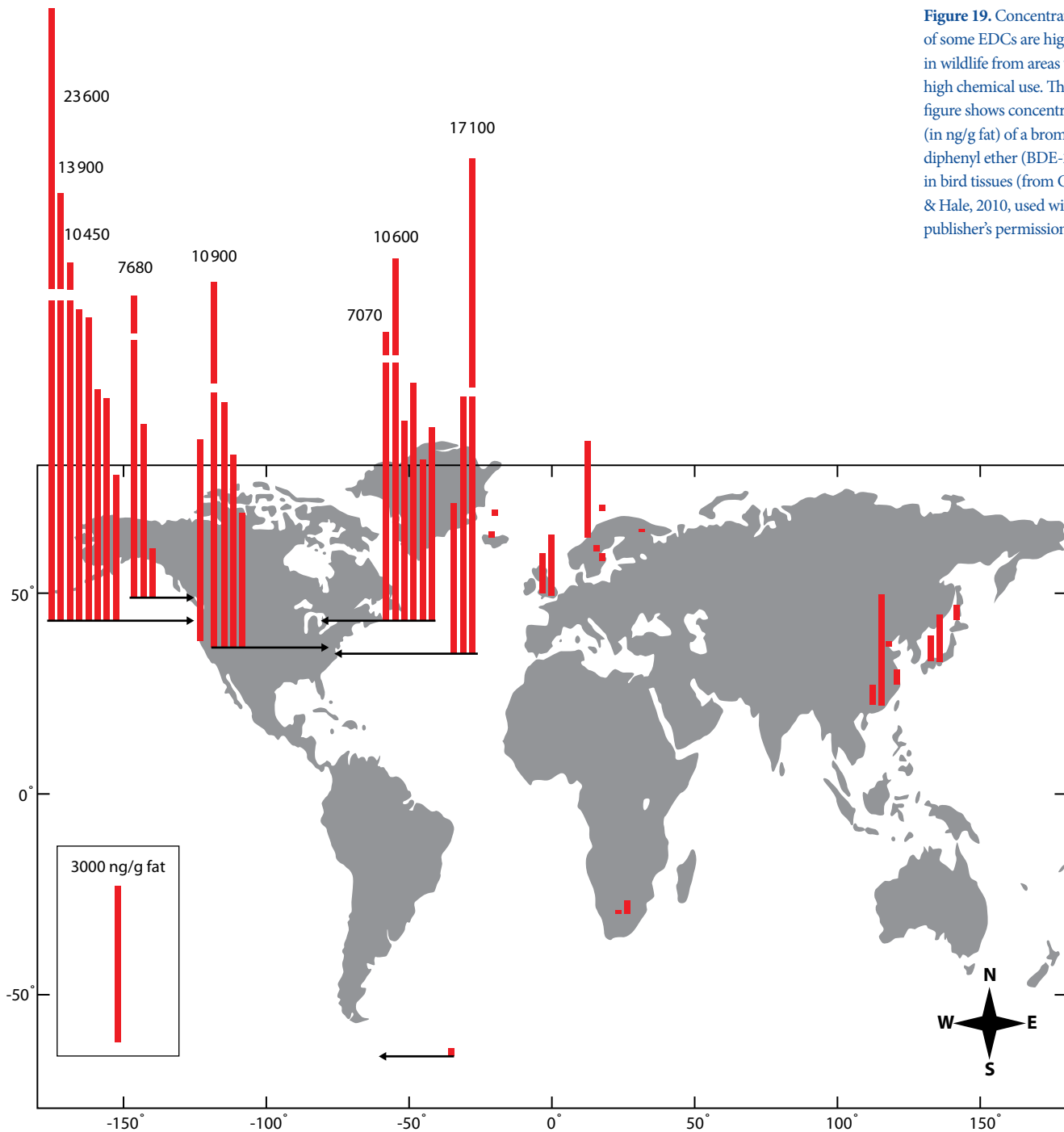


Figure 18. EDCs are found in wildlife worldwide. This figure shows concentrations (in ng/g wet weight) of perfluorooctane sulfonate, also known as PFOS, in liver of marine mammals (modified from Houde et al., 2011).

transport by air and ocean currents and food web accumulation. A few examples of exposure of wildlife around the world are shown in **Figures 18 and 19**. There are no longer any pristine areas without environmental pollutants. In addition, levels of chemicals in the body are tightly linked to trends in their use. There are good examples where bans or reductions in chemical use have resulted in reduced levels in humans and wildlife. Indeed, human and animal tissue concentrations of many POPs have declined because the chemicals are being phased out following global bans on their use. In contrast, EDCs that are being used more now are found at higher levels in humans and wildlife. It is notable how well production and exposure mirror each other, as exemplified in **Figure 20**.

Hundreds of chemicals in commerce are known to have endocrine disrupting effects. However, thousands of other chemicals with potential endocrine effects have not been looked for or tested. It is likely that these chemicals are contributing to wildlife and human exposures to EDCs. The situation is illustrated in **Figure 21**. Since only a very limited number of all chemicals in commerce have been tested for their endocrine disrupting properties, there may be many more with such properties. Also, the EDC metabolites or environmental transformation products and the by-products and products formed upon waste treatment are not included in these estimates, and their endocrine disrupting effects are mainly unknown.



10. The tip of the iceberg

Because only a small fraction of the hundreds of thousands of synthetic chemicals in existence have been assessed for endocrine disrupting activity, and because many chemicals in consumer products are not identified by the manufacturer, we have only looked at the “tip of the iceberg”. How many EDCs are there?

Where do they come from? What are the human and wildlife exposures? What are their effects individually and in mixtures during development and adulthood and even across generations? What are their mechanisms of action? How can testing for EDCs be improved? All of these questions need answers.

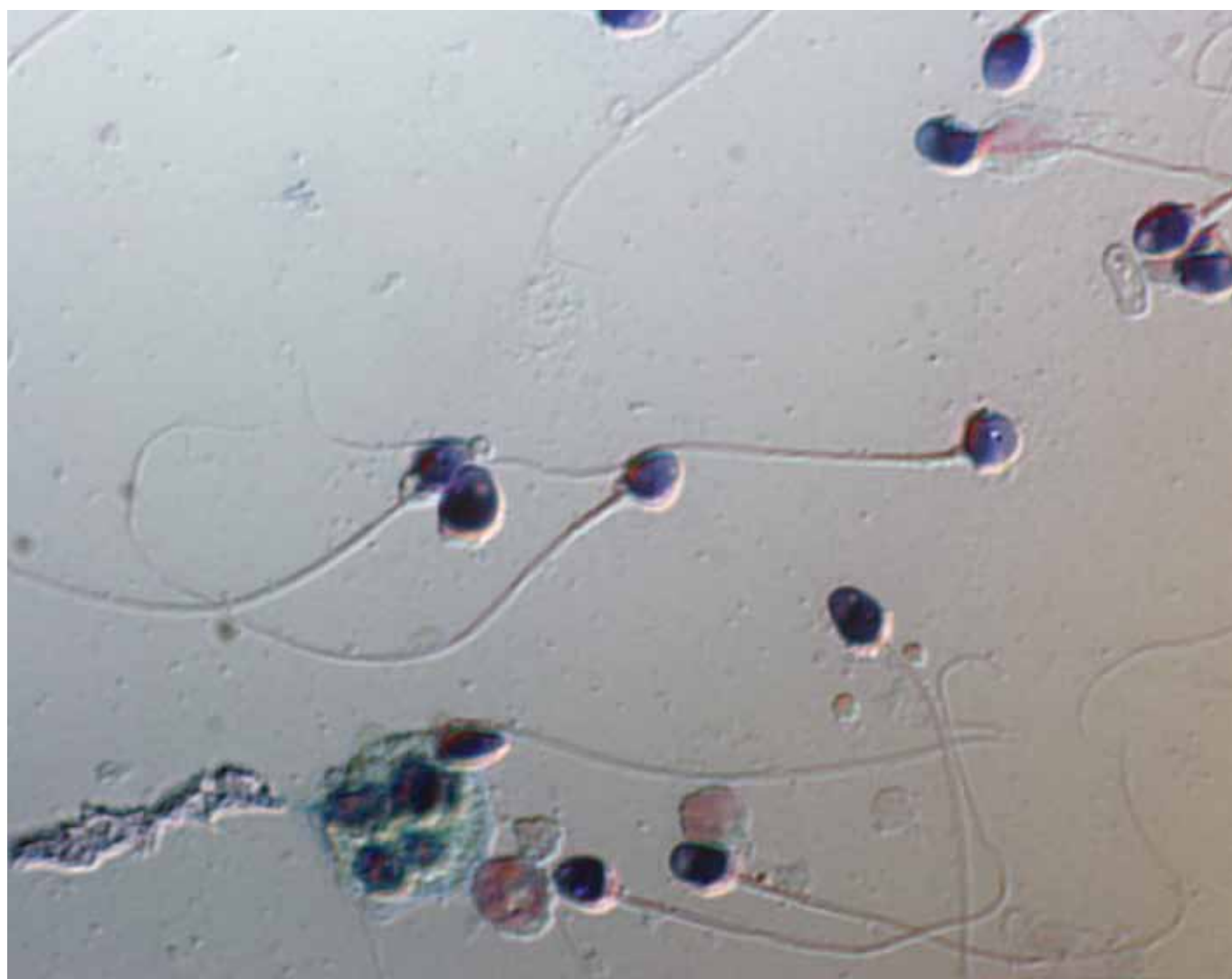


11. Testing for EDCs

Since there are data from epidemiological studies showing associations between human disease end-points and EDC exposures, it is likely that endocrine diseases and disorders are occurring at current exposure levels. Put another way, this means that there are situations in which individually safe exposures of EDCs have reached a collectively harmful level or in which levels thought to be safe are not so.

When chemicals are tested for endocrine disrupting activity under specific validated guideline studies, it is customary to examine three doses to determine a level not apparently associated with observable effects. This level, termed the no-observed-adverse-effect level, is then divided by a so-called safety or uncertainty factor (of 100, for example) to extrapolate to levels expected to be safe for humans or wildlife. The doses declared safe are not actually tested,

nor are the mixtures. These studies also assume that there is a threshold for EDC effects, that there will be no effects at low doses and that the dose-response curve rises with increasing dose. As noted above, there is no threshold for EDC effects due to the presence of active hormone pathways, and EDCs are likely to have effects at low doses. Consequently, their dose-response curves will not necessarily rise in proportion to dose. Regulatory guideline studies also focus on histopathology and organ and body weights as the end-points. As noted above, EDCs can cause many diseases and affect many disease end-points that are not currently assessed in regulatory studies. Also, risk assessment approaches do not always assess toxicity during development, which is the most sensitive window for EDC action, and also do not follow the animals for their lifetime, which is needed to assess resulting diseases.



12. Lessons from the past

How can society protect our health and that of future generations from the actions of EDCs? What can we learn from the past that will help us?

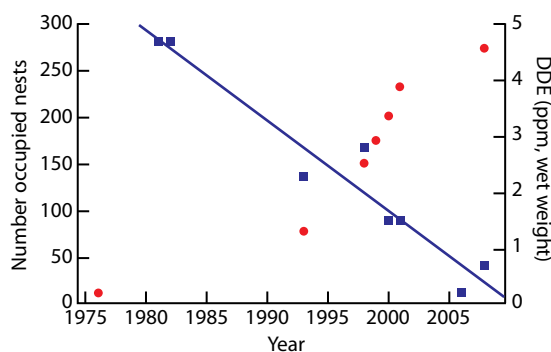
One option is to ban a chemical shown to cause toxicity and disease. Over the last 40 years, only a handful of chemicals—e.g. lead, POPs, tributyltin, di(2-ethylhexyl)phthalate, nonylphenol and chlorpyrifos—have been banned in many countries, and sometimes these bans concern specific uses only. Nonetheless, there have been clear benefits for human and wildlife health from the declining use of these chemicals.

One of the best examples of positive action is the banning of residential use of the organophosphate insecticide chlorpyrifos in the USA in 2000. Chlorpyrifos has been shown to be a potent neurotoxicant, causing

developmental delays, attention problems and ADHD in children. Today, the manufacturer in question has phased out products for residential uses around the world; the chemical is still used professionally worldwide as an insecticide on fruits and vegetables in commercial agriculture. Following the residential ban in the USA, children's blood levels in New York declined significantly within one year and were reduced to less than half within two years.

Tributyltin is particularly interesting, as it was banned from use on ship hulls due to its reproductive effects on molluscs. In harbours where tributyltin use has declined, environmental levels have decreased, and so too have the effects of this EDC on the wildlife living in these areas. However, organotinns are still used as fungicides on numerous plants and as components in polyvinyl chloride plastic.

Figure 22. Wildlife populations affected by EDCs can recover after a ban of the chemical. This figure shows declining DDE (“blue square”) concentrations (in parts per million wet weight) in osprey eggs in relation to the number of osprey nests occupied (“red dot”) in Oregon, USA (based on data in Henny et al., 2010).



POPs such as PCBs and DDT were banned in many countries over 20 years ago due to their environmental persistence and toxicity. As a result, their levels in humans and wildlife have declined in recent decades. Bird populations exposed to high levels of DDT, and in particular to its persistent metabolite, DDE, in the 1950s through 1970s in North America and Europe are, since 1975, showing lower concentrations of DDT and DDE and clear signs of recovery (**Figure 22**). However, there are studies showing that current low levels of these persistent chemicals are still causing harm, because they or their breakdown products remain in the environment long after their use has been banned.

Lead is an important example of the cost of inaction in the face of toxicity data. Lead has been a known neurotoxicant since the Roman times; nonetheless, it was used in gasoline and paint around the world. The impact of lead on children is profound, because it causes irreversible damage to developing bone and

brain tissues. The most damaging impact resulted from the use of lead in gasoline, which caused an estimated intelligence quotient (IQ) loss of five points in millions of children worldwide.

The ban on tetraethyl lead in gasoline occurred only after decades of inaction, when substitutes were available. Following the ban in the USA, lead levels in children fell dramatically, showing that the ban had a huge impact on improving human health (**Figure 23**).

While this is an example of success, the scientific data were present many years before the policies were changed and the chemical was banned. During that time, children's health continued to be harmed. So the question is, when are there sufficient data to act? Perhaps the answer is in making more use of the precautionary principle to ban or restrict chemicals in order to reduce exposure early, even when there are significant but incomplete data and before there is significant and long-lasting harm.

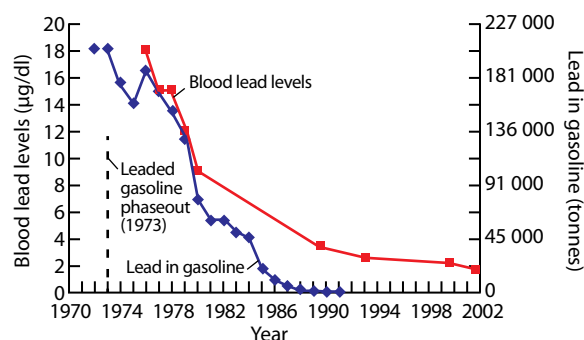


Figure 23. Ban on lead in gasoline and the impact of this decision on children's blood lead levels (based on data from the National Health and Nutrition Examination Survey in the USA).

13. Main conclusions and advances in knowledge since 2002

General aspects on endocrine disruption: Some endocrine disruptors can act directly on hormone receptors as hormone mimics or blockers. Others can act directly on any number of proteins that control the delivery of a hormone to its normal target cell or tissue. Further, the affinity of an endocrine disruptor to a hormone receptor is not equivalent to its potency, and the chemical potency on a hormone system is dependent upon many factors. Also, endocrine disruption represents a special form of toxicity, and this must be taken into consideration when interpreting the results of studies of EDCs or when designing studies to clarify the effects of EDCs and quantifying the risks to human and wildlife health.

Environmental chemicals can exert endocrine disrupting activity on more than just estrogen, androgen and thyroid hormone action. Some are known to interact with multiple hormone receptors simultaneously. Sensitivity to endocrine disruption is highest during tissue development; developmental effects will occur at lower doses than are required for effects in adults. Hence, testing for endocrine disruption must encompass the developmental period and include lifelong follow-up to assess latent effects.

Over the last 10 years, it has been established that endocrine disruptors can work together to produce additive effects, even when combined at low doses that individually do not produce observable effects. It has also become evident that endocrine disruptors may produce non-linear dose-response curves both in vitro and in vivo, by a variety of mechanisms.

Female reproductive health: Animal studies have shown that EDC exposures during early development can cause altered mammary gland and uterine development, accelerated or delayed puberty in females, disruption of fertility cycles, fibroids and endometriosis-like symptoms. These effects are similar to those seen in human populations, and it is reasonable to suspect that EDCs are adversely affecting human female reproductive health. Few studies have explored the role of EDCs and potential EDCs in causing female reproductive health disorders. Most of the available evidence comes from studies of adults rather than babies or children and often from exposures to POPs. Understanding of the contribution from more modern chemicals has only recently expanded.

There is much conflicting epidemiological evidence regarding the involvement of EDCs in premature puberty and breast development, menstrual cycles and adverse pregnancy outcomes (including preterm birth) in women. This is hardly surprising, considering the complexity of relating exposure measures to health outcomes relative to the timing and duration of exposures and including confounding factors such as maternal age and weight and the quality of prenatal care. There has been insufficient study of the relationship between EDC exposures and polycystic ovarian syndrome or fibroids in women. Limited data link phthalate exposures with increased fibroid prevalence. A number of studies have examined associations between exposure to chemicals and endometriosis, although most have measured exposure in adult life. PCBs, dioxins and phthalates are implicated, although studies are sometimes conflicting.

Historically high incidences of fibroids have also occurred in seal populations in the Baltic Sea and have been associated with exposure to contaminants (particularly PCBs and organochlorine pesticides). Recovery of these populations is now occurring, following a decline in the concentrations of these chemicals. More evidence now exists that reduced reproductive success in female birds, fish and gastropods is related to exposure to PCBs and dioxins. As exposure to these EDCs decreased, adverse reproductive effects in wild populations also decreased.

Male reproductive health: Occupational or accidental exposure of pregnant women to estrogen (DES) or to mixtures of EDCs that interfere with male hormone action (e.g. anti-androgenic pesticides) increases the risk of testicular non-descent (cryptorchidism) in their sons, causing reduced semen quality and increased risk of subfertility and testicular cancer in adult life. No associations have been found with individual chemicals, underlining the importance of including mixtures assessment in epidemiological and laboratory investigations.

Cryptorchidism is sometimes found together with penile malformations (hypospadias). Limited evidence suggests a slightly increased risk of hypospadias or of reduced semen quality associated with exposure to mixtures of endocrine disrupting pesticides. Limited evidence also

suggests links between maternal phthalate exposure and reduced anogenital distance (a proxy for reduced semen quality) in baby boys. For most chemicals, associations between fetal exposure and childhood or adult male reproductive health have not been studied. Few data sets contain measures of chemical exposures in pregnant women and of semen quality in their adult sons 20–40 years later.

Laboratory experiments with rats and epidemiological studies strongly suggest that the co-occurrence of cryptorchidism, hypospadias, testis germ cell cancer and impaired semen quality is the result of reduced androgen action during fetal development, causing testicular dysgenesis syndrome. Using the rat model, a large and convincing body of literature shows that a wide range of anti-androgenic and estrogenic EDCs can cause testicular dysgenesis syndrome in the laboratory rat. Chemicals testing positive in this model include phthalate plasticizers and a range of anti-androgenic fungicides and pesticides. Limited evidence also exists for the painkiller paracetamol. Effects of phthalates in the rat are not seen in the mouse or in human testis *ex vivo*, and for bisphenol A (BPA), the human testis model is more sensitive to toxic effects than the rat model. Better models of the human testis are needed for use in chemical testing.

With the exception of testicular germ cell cancers, which are logistically difficult to detect, symptoms of androgen deficiency and estrogen exposure also occur in a variety of wildlife species in both urban and rural environments and have been associated with exposure to chemicals in a limited number of species in some areas. The feminizing effects of estrogenic chemicals from sewage effluents on male fish was first reported in the 1990s and have now been seen in many countries and in several species of fish, indicating that this is a widespread phenomenon. Feminized (intersex) male fish have reduced sperm production and reduced reproductive success. The suite of effects seen in wildlife can be reproduced in laboratory studies in which experimental animals are exposed to estrogenic and anti-androgenic EDCs.

Sex ratios: EDC-related sex ratio imbalances, resulting in fewer male offspring in humans, do exist as shown for 2,3,7,8-tetrachlorodibenzo-p-dioxin and 1,2-dibromo-3-chloropropane, although the underlying mechanisms are unknown. Also, EDC-related sex ratio imbalances have been seen in wild fish and molluscs, and the effects of EDCs on sex ratios in some of these species are also supported by laboratory evidence.

Human fertility rates: Fertility rates are declining all over the world, particularly in industrialized countries. Although today we see stable, but ageing, human populations in Japan and Europe, we shall soon see significant reductions in their populations, as their fertility rates have been below replacement levels for 20–40 years. Contraception and changes in social family structures help explain these changes, although increasing reproductive health problems among men and women may also be important factors.

Population declines in wildlife: Wildlife species and populations continue to decline worldwide due to a number of factors, including overexploitation, loss of habitat, climate change and chemical contamination. Given our understanding of EDCs and their effects on the reproductive system, it is extremely likely that declines in the numbers of some wildlife populations (raptors, seals and snails) were because of the effects of chemicals (DDT, PCBs and tributyltin, respectively) on these species. The evidence for POPs as a cause of these population declines has increased now relative to 2002, due to increases in these populations following the restrictions on the use of these chemicals. EDCs in modern commerce with mechanisms of action similar to those of POPs are suspected to also be a factor contributing to declines seen in wildlife species today. Demonstrating a clear link between endocrine effects in individuals and population declines or other effects will always be challenging, however, because of the difficulty in isolating the effects of chemicals from the effects of other stressors and ecological factors. An endocrine mechanism for current wildlife declines is probable but not proven.

Thyroid health: Epidemiological evidence suggests that several groups of common contaminants, including PCBs, brominated flame retardants, phthalates, BPA and perfluorinated chemicals, are associated with reduced serum thyroid hormone levels in humans. Moreover, a much longer list of chemicals has caused a reduction in circulating levels of thyroid hormones or interfered directly with thyroid hormone action in experimental animals. Severe thyroid hormone deficiency causes severe brain damage, such that universal screening of thyroid hormone levels in serum occurs all over the world. Moderate (25%) or even transient insufficiency of thyroid hormones during pregnancy is also associated with reduced IQ, ADHD and even autism in children and with hypothyroid disorders in adults. Moreover, reduced serum thyroid hormone levels, although

still within population ranges classified as clinically “normal”, have been identified as risk factors for increased serum cholesterol and elevated blood pressure and reduced bone density in postmenopausal women and so will be useful measures to investigate the relationship between chemical exposures and disease.

Not all studies will find exactly the same relationships between exposure and disease outcomes due to the difficulties in standardizing exposure measures and levels of hormones relative to the timing and duration of exposure. For thyroid hormones, levels are so variable between individuals that multiple measures in the same individual would be required to estimate a “set point” with a precision of 5%. This known variability should be incorporated into study designs. The issue is whether the correlations between contaminant exposure and various measures of endocrine function are consistent with effects on population health that are mediated by effects on hormone action. The complexity underlying the data is interpreted by some to indicate that there is no convincing evidence that chemicals can interfere with thyroid hormone action in humans. Considering that there is strong evidence linking thyroid hormone levels with adverse outcomes, particularly in children, precautionary approaches are necessary.

There is strong evidence to conclude that thyroid hormones play the same role in brain development in both animals and humans. Therefore, rodents are useful models for testing chemicals in order to protect human populations from additional exposures. The current set of validated test methods and human clinical measures, however, considers changes in thyroid hormone levels only and needs to be improved to encompass changes in thyroid hormone action. This means that there could be inconsistent relationships between exposure to thyroid disrupting chemicals and measures of thyroid function in humans, but very strong evidence in animals indicating that chemicals can interfere with thyroid hormone action. This is certainly true for PCBs.

Evidence of relationships between exposure to chemicals and thyroid hormone disruption in wildlife species has improved in the last decade, especially in relation to exposure to the flame retardant PBDEs and PCBs, but other chemicals have been inadequately studied. The strength of evidence supporting a role for EDCs in disrupting thyroid function in wildlife adds credence to the hypothesis that this could occur in humans.

Thyroid disruption is acknowledged to be poorly addressed by the chemical tests currently listed in the Organisation for Economic Co-operation and Development (OECD) conceptual framework. Genetic lines of mice are now widely available that could help clarify the mechanisms by which chemical exposures can interfere with thyroid hormone action.

Neurodevelopment: It is not widely appreciated that hormones play many critical roles in neurodevelopment, including the neuroendocrine circuits that control sex-specific behaviour and physiology, and therefore that EDCs could cause a series of behavioural conditions and psychiatric disorders that are evident in societies. Sufficient data indicate that in utero exposure to EDCs affects cognition in animal studies, and limited data indicate that sexually dimorphic behaviours are also affected. Although some test guidelines for developmental neurotoxicity have been developed, no chemical testing strategies currently require evaluation of the ability of chemicals to produce such effects.

There are sufficient data in human populations to conclude that high exposures to thyroid disrupting PCBs during fetal development (e.g. the children whose mothers ate contaminated fish from Lake Michigan or in the Yu-Cheng, or “oil disease”, children born to mothers exposed to PCBs) or to potential EDCs, such as lead and mercury, are linked to general cognitive problems and alterations in sexual behaviour. Even relatively low exposures, however, are associated with reduced cognitive function. The most consistent observations are with impaired executive functioning, followed by processing speed, verbal ability and visual recognition and memory. ADHD is overrepresented in children whose mothers had low thyroxine levels in the first trimester of pregnancy and in populations with elevated exposure to organophosphate pesticides, still found in some populations. There is almost no information concerning the effects of mixtures of neuroendocrine disruptors, even though we know that they co-exist in human tissues. Data available suggest additive effects of different chemicals.

Studies of exposed wildlife provide important information on exposure levels, early and subclinical effects and the clinical neurotoxicity of EDCs, because the mechanisms, underlying effects and outcomes of exposure are often similar to those in humans. Data showing effects on growth, development and behaviour in wildlife exist for some PCBs and mercury, but are sparse or non-existent for other EDCs.

Hormone-related cancers: Despite a great deal of research, the causes of most hormonal cancers are a mystery. It is clear that hormones are required for the growth of cancerous tissues, but their involvement in the earlier stages of carcinogenesis, through perhaps epigenetic effects, is unclear. Studies with animals now show that exposure to hormones (synthetic or natural) or EDCs (e.g. PCBs, PBDEs, dioxins, some organochlorine pesticides, BPA) during early development of some endocrine glands (e.g. breast, endometrium, prostate) can alter their development, perhaps through effects on stem cells, with possible consequences for susceptibility to cancer. In some cases, cancer has been demonstrated in these animals. In the thyroid gland, the existence of stem cells has been hypothesized, but not demonstrated. Although various chemicals have been shown to cause thyroid cancer in animals, current understanding of thyroid cancer does not link it to an endocrine mechanism.

Many poorly designed and conflicting studies have arisen, until very recently, from lack of knowledge that exposures must consider mixtures and must be measured before the cancer appears, in fetal development, in many cases. This means that, despite growing evidence that hormones are risk factors for several endocrine cancers, few epidemiological studies have shown links with EDCs. For breast cancer, the most convincing evidence appears to come from associations with EDCs devoid of estrogenic activity, such as dioxins and furans, for which sufficient evidence exists. For endometrial and ovarian cancer, very few studies have been carried out, and those that exist are conflicting. For prostate cancer, sufficient evidence exists for an association with exposures to mixtures of pesticides in agriculture and in pesticide manufacturing and to cadmium and arsenic, whereas evidence is conflicting for an association with PCB and organochlorine exposures. Many of the pesticides are acetylcholinesterase inhibitors, which also interfere with metabolic conversion of hormones. Very many chemicals have not been investigated at all. For thyroid cancer, limited studies indicate higher rates in pesticide applicators, although some of these also stem from iodine deficiencies in these people.

Similar types of cancers of the endocrine organs, particularly reproductive organs, are also found in wildlife species (several species of marine mammals and invertebrates) and in domestic pets. In wildlife, endocrine tumours tend to be more common in animals living in polluted regions than in those inhabiting more pristine environments.

There are many deficiencies in regulatory testing methodologies for EDCs. Rodent strains developed for carcinogen testing were not developed as models for the demonstration of mammary cancer; an animal mammary carcinogen may be a human carcinogen, but not necessarily with the breast as a target organ. Other rat strains not routinely used for testing would be more suitable for testing, but have hitherto been used for only a handful of chemicals.

Adrenal disorders: Numerous chemicals, mainly POPs, potentially affecting adrenal structure and function have been described using in vitro assays, but no studies have investigated EDC associations with adrenal hormone secretion in humans. Few studies have been carried out with laboratory animals. The great majority of chemicals in commerce have not been tested.

Bone disorders: It is well established that bone is a target tissue for estrogens, which affect bone mineralization and maturation. Very little evidence, however, exists for effects of EDCs on these processes, except in cases of accidental high-exposure incidents with hexachlorobenzene, PCBs and polychlorinated dibenzofurans and in people eating contaminated fish from the Baltic Sea.

Metabolic disorders: The control of metabolism involves many components of the endocrine system, including the adipose tissues, brain, skeletal muscle, liver, pancreas, thyroid gland and gastrointestinal tract. There are now animal data showing that embryonic exposure to EDCs or potential EDCs (e.g. tributyltin, BPA, some organochlorine and organophosphate pesticides, lead, perfluorooctanoic acid, phthalates) leads to altered cholesterol metabolism, possible weight gain and type 2 diabetes in adulthood. There are no compelling animal data linking chemical exposures to type 1 diabetes, although some chemicals can affect the function of insulin-producing beta cells in the pancreas, including BPA, PCBs, dioxins, arsenic and some phthalates. Many of these chemicals are also immunotoxic in animal models, and so it is plausible that they could act via both immune and endocrine mechanisms to cause type 1 diabetes. Metabolic syndrome may also result from chemical exposures, although there has been little study of this.

Limited epidemiological data exist to support the notion that EDC exposure during pregnancy can affect weight gain in infants and children. Limited epidemiological data show that adult exposures to some EDCs (mainly POPs, arsenic and BPA) are associated with type 2 diabetes, but there are

no data for type 1 diabetes, there is insufficient evidence of endocrine mechanisms and there is insufficient study of this area in general.

Immune disorders: It is increasingly clear that EDCs likely play a role in the rise in immune-related disorders in both humans and wildlife. Many immune disorders have well-established ties to the endocrine system, such that disruption of select endocrine pathways may disturb the immune response, potentially causing allergies, endometriosis, bone disorders, autoimmune thyroid disease and immune cancers. This is because the immune and endocrine systems are intricately connected through cross-talk between certain hormonal receptors and immune signalling pathways. Sufficient data now support a role for the lipid X receptor (LXR) and the steroid and xenobiotic receptor (SXR) in regulating white blood cell proliferation, and there are data linking inflammation, immune dysfunction and immune cancers with EDCs.

Several studies with animals have demonstrated activation or repression of receptor signalling pathways involved in immune–endocrine interactions by organochlorine pesticides, PCBs, organotins, alkylphenols, phthalates, atrazine and BPA. Limited experimental and epidemiological evidence suggests that some PCBs, estrogens, atrazine and phthalates are developmental immunotoxicants, causing increased risk of inflammatory and autoimmune disorders. There are strong links, supported by animal studies, between phthalate exposure and the rising incidence of asthma. Endocrine mechanisms are highly plausible, but are not always proven or investigated. Together, these new insights stress a critical need to better understand how EDCs affect normal immune function and immune disorders and how windows of exposure may affect disease incidence (particularly for childhood respiratory diseases).

Human and wildlife exposures to EDCs: There is far more knowledge on EDC exposure today than there was 10 years ago. This applies to the diversity of chemicals being implicated as EDCs and exposure routes and levels in humans and wildlife. As examples, brominated flame retardants were mentioned only briefly and perfluorinated compounds not at all when the IPCS document on EDCs was prepared 10 years ago (IPCS, 2002). In addition to these, there are now many more EDCs being found in both humans and wildlife. The most relevant main messages regarding exposure to EDCs are summarized below.

Unlike 10 years ago, it is now better understood that humans and wildlife are exposed to far more EDCs than just POPs. EDCs are chemically diverse, are primarily man-made chemicals and are used in a wide range of materials and goods. EDCs are present in food, nature (wildlife) and human beings. They can also be formed as breakdown products from other anthropogenic chemicals in the environment and in humans, wildlife and plants. Humans and wildlife are exposed to multiple EDCs at the same time, and there is justifiable concern that different EDCs can act together and result in an increased risk of adverse effects on human and wildlife health. Exposures to EDCs occur during vulnerable periods of human and wildlife development—from fertilization through fetal development and through nursing of young offspring—which raises particular concern. Children can have higher exposures due to their hand-to-mouth activities and higher metabolic rate.

Right now, only a narrow spectrum of chemicals and a few classes of EDCs are measured, making up the “tip of the iceberg”. More comprehensive assessments of human and wildlife exposures to diverse mixtures of EDCs are needed. It should be a global priority to develop the capacities to measure any potential EDCs. Ideally, an “exposome”, or a highly detailed map of environmental exposures that might occur throughout a lifetime, should be developed. New sources of exposure to EDCs, in addition to food, have been identified and include indoor environments and electronics recycling and dumpsites (the latter being issues of particular concern for developing countries and countries with economies in transition). Not all sources of exposure to EDCs are known because of the lack of chemical constituent declarations for materials and goods.

There is global transport of EDCs through natural processes (ocean and air currents) as well as through commerce, leading to worldwide exposure of humans and wildlife to EDCs. Spatial and temporal monitoring is critical for understanding trends and levels of exposure. This monitoring should include tissues from both humans and wildlife (representing a range of species) as well as water or other environmental compartments to capture the less persistent EDCs. Levels in humans and wildlife are related to how much a chemical is used. Bans on several POPs have led to declines in environmental levels and human body burdens. In contrast, there are increasing levels of some newer EDCs, such as perfluorinated alkyl compounds and replacements for banned brominated flame retardants.

14. Concluding remarks

EDCs have the capacity to interfere with tissue and organ development and function, and therefore they may alter susceptibility to different types of diseases throughout life. This is a global threat that needs to be resolved.

Progress

We are starting to understand that a large number of non-communicable diseases have their origin during development and that environmental factors interact with our genetic background to increase susceptibility to a variety of diseases and disorders. It is also clear that one of the important environmental risk factors for endocrine disease is exposure to EDCs during development. It is also clear from human studies that we are exposed to perhaps hundreds of environmental chemicals at any one time. It is now virtually impossible to examine an unexposed population around the globe. Trends indicate an increasing burden of certain endocrine diseases across the globe in which EDCs are likely playing an important role, and future generations may also be affected.

The advances in our understanding of EDCs have been based mainly on information derived from studies in developed regions. As in 2002, there is still a major lack of data from large parts of the world, in particular from Africa, Asia and Central and South America.

Future needs

Better information on how and when EDCs act is needed to reduce exposures during development and prevent disease from occurring. A clear example of the success of primary prevention through exposure control is lead. We have identified the following needs to take advantage of current knowledge to improve human and wildlife health by prevention of environmentally induced diseases.

A. Strengthening knowledge of EDCs: It is critical to move beyond the piecemeal, one chemical at a time, one disease at a time, one dose approach currently used by scientists studying animal models, humans or wildlife. Understanding the effects of the mixtures of chemicals to which humans and wildlife are exposed is increasingly important. Assessment of EDC action by scientists needs to take into account the characteristics of the endocrine system that are being disrupted, including tissue specificity and sensitive windows of exposure across the lifespan. While there are different perspectives on the importance of low-dose effects and non-monotonic dose-response curves for EDCs, this issue is important in determining whether current testing protocols are

sufficient to identify EDCs. Interdisciplinary efforts that combine knowledge from wildlife, experimental animal and human studies are needed to provide a more holistic approach for identifying the chemicals that are responsible for the increased incidence of endocrine-related disease and dysfunction. The known EDCs may not be representative of the full range of relevant molecular structures and properties due to a far too narrow focus on halogenated chemicals for many exposure assessments and testing for endocrine disrupting effects. Thus, research is needed to identify other possible EDCs. Endocrine disruption is no longer limited to estrogenic, androgenic and thyroid pathways. Chemicals also interfere with metabolism, fat storage, bone development and the immune system, and this suggests that all endocrine systems can and will be affected by EDCs. Together, these new insights stress a critical need to acquire a better understanding of the endocrine system to determine how EDCs affect normal endocrine function, how windows of exposure may affect disease incidence (particularly for childhood respiratory diseases) and how these effects may be passed on to generations to come.

Furthermore, new approaches are needed to examine the effects of mixtures of endocrine disruptors on disease susceptibility and etiology, as examination of one endocrine disruptor at a time is likely to underestimate the combined risk from simultaneous exposure to multiple endocrine disruptors. Assessment of human health effects due to EDCs needs to include the effects of exposure to chemical mixtures on a single disease as well as the effects of exposure to a single chemical on multiple diseases. Since human studies, while important, cannot show cause and effect, it is critical to develop cause and effect data in animals to support the studies on humans.

B. Improved testing for EDCs: Validated screening and testing systems have been developed by a number of governments, and it requires considerable time and effort to ensure that these systems function properly. These systems include both in vitro and in vivo end-points and various species, including fish, amphibians and mammals. New approaches are also being explored whereby large batteries of high-throughput in vitro tests are being investigated for their ability to predict toxicity, the results of which may be used in hazard identification and potentially risk assessment. These new approaches are important as one considers the number of chemicals for which there is no information, and these high-throughput assays may provide important, albeit incomplete, information. An additional challenge to moving forward is that EDC research over the past decade has

revealed the complex interactions of some chemicals with endocrine systems, which may escape detection in current validated test systems. Finally, it will be important to develop weight-of-evidence approaches that allow effective consideration of research from all levels—from in vitro mechanistic data to human epidemiological data.

C. Reducing exposures and thereby vulnerability

to disease: It is imperative that we know the nature of EDCs to which humans and wildlife are exposed, together with information about their concentrations in blood, placenta, amniotic fluid and other tissues, across lifespans, sexes, ethnicities (or species of wildlife) and regions. Many information gaps currently exist with regard to what is found in human and wildlife tissues, more so for developing countries and countries with economies in transition and for chemicals that are less bioaccumulative in the body. Long-term records to help us understand changes in exposures exist only for POPs and only for a few countries.

In addition, there is a need to continue expanding the list of chemicals currently examined to include those contained in materials and goods as well as chemical by-products; it is impossible to assess exposure without knowing the chemicals to target. The comprehensive measurement of all exposure events during a lifetime is needed, as opposed to biomonitoring at specific time points, and this requires longitudinal sampling, particularly during critical life stages, such as fetal development, early childhood and the reproductive years.

Wildlife and humans are exposed to a wide variety of EDCs that differ greatly in their physical and chemical properties. Further, these compounds are generally present at trace concentrations and in complex matrices requiring highly selective and sensitive analytical methods for their measurement. The wide range of different compound classes requires a variety of analytical approaches and techniques, making it challenging to understand all of the different chemicals in the environment and in human and wildlife tissues. There is a growing need to develop new analytical techniques and approaches to prioritize the assessment of EDCs. There is global transport of EDCs through natural processes (ocean and air currents) as well as commerce, leading to worldwide exposures. New sources of exposure to EDCs, in addition to food, have been identified and include indoor environments and electronics recycling and dumpsites (of particular concern in developing countries and countries with economies in transition). The sources and routes of exposure to EDCs need to be further investigated.

D. Identifying endocrine active chemicals: Identifying chemicals with endocrine disrupting potential among

all of the chemicals used and released worldwide is a major challenge, and it is likely that we are currently assessing only the “tip of the iceberg.” It is possible to trace high production volume chemicals, but that is not the case for the numerous additives and process chemicals. Adding greatly to the complexity, and to the number of chemicals in our environment, are the unknown or unintended by-products that are formed during chemical manufacturing, during combustion processes and via environmental transformations. While the active ingredients in pharmaceuticals and pesticides have to be documented on the final product, this is not the case for chemicals in articles, materials and goods. Personal hygiene products and cosmetics require declarations of the ingredients, and the number of chemicals applied in this sphere of uses counts in the thousands. Many sources of EDCs are not known because of a lack of chemical constituent declarations in products, materials and goods. We need to know where the exposures are coming from.

E. Creating enabling environments for scientific advances, innovation and disease prevention:

Exposure to EDCs and their effects on human and wildlife health are a global problem that will require global solutions. More programmes are needed that foster collaboration and data sharing among scientists and between governmental agencies and countries. To protect human health from the combined effects of exposures to EDCs, poor nutrition and poor living conditions, there is a need to develop programmes and collaborations among developed and developing countries and those in economic transition. There is also a need to stimulate new adaptive approaches that break down institutional and traditional scientific barriers and stimulate interdisciplinary and multidisciplinary team science.

F. Methods for evaluating evidence: There is currently no widely agreed system for evaluating the strength of evidence of associations between exposures to chemicals (including EDCs) and adverse health outcomes. A transparent methodology is also missing. The need for developing better approaches for evaluating the strength of evidence, together with improved methods of risk assessment, is widely recognized. Methods for synthesizing the science into evidence-based decisions have been developed and validated in clinical arenas. However, due to differences between environmental and clinical health sciences, the evidence base and decision context of these methods are not applicable to exposures to environmental contaminants, including EDCs. To meet this challenge, it will be necessary to exploit new methodological approaches. It is essential to evaluate associations between EDC exposures and health outcomes by further developing methods for which proof of concept is currently under development.

15. References

- Chen D, Hale RC (2010). A global review of polybrominated diphenyl ether flame retardant contamination in birds. *Environment International*, 36:800–811.
- Diamanti-Kandarakis E et al. (2009). Endocrine-disrupting chemicals: an Endocrine Society scientific statement. *Endocrine Reviews*, 30(4):293–342.
- European Environment Agency (2012). *The impacts of endocrine disruptors on wildlife, people and their environments—The Weybridge+15 (1996–2011) report*. Copenhagen, Denmark, European Environment Agency, 112 pp. (Technical Report No. 2/2012).
- Helm D (2007). Correlation between production amounts of DEHP and daily intake. *Science of the Total Environment*, 388:389–391.
- Henny CJ et al. (2010). North American osprey populations and contaminants: historic and contemporary perspectives. *Journal of Toxicology and Environmental Health. Part B, Critical Reviews*, 13(7–8):579–603.
- Houde M et al. (2011). Biological assessment and biomagnification of polyfluoroalkyl acids (PFAAs) in aquatic ecosystems: an updated review. *Environmental Science and Technology*, 45(19):7962–7973.
- IPCS (2002). *Global assessment of the state-of-the-science of endocrine disruptors*. Geneva, Switzerland, World Health Organization, International Programme on Chemical Safety.
- Kortenkamp A et al. (2011). *State of the art assessment of endocrine disruptors. Final report*. European Commission, Directorate-General for the Environment (Project Contract No. 070307/2009/550687/SER/D3).
- Krahn MM et al. (2007). Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. *Marine Pollution Bulletin*, 54(12):1903–1911.
- Prüss-Üstün A, Corvalán C (2006). Analysis of estimates of the environmentally attributable fraction, by disease. Chap. 5 in: *Preventing disease through healthy environments: towards an estimate of the environmental burden of disease*. Geneva, Switzerland, World Health Organization (http://www.who.int/quantifying_ehimpacts/publications/preventingdisease/en/, accessed 10 November 2011).
- Rayne S et al. (2004). PBDEs, PBBs, and PCNs in three communities of free-ranging killer whales (*Orcinus orca*) from the northeastern Pacific Ocean. *Environmental Science and Technology*, 38(16):4293–4299.
- Richiardi L et al. (2004). Testicular cancer incidence in eight northern European countries: secular and recent trends. *Cancer Epidemiology, Biomarkers & Prevention*, 13(12):2157–2166.
- Rolland et al. (2012). Decline in semen concentration and morphology in a sample of 26 609 men close to general population between 1989 and 2005 in France. *Journal of human reproduction*. Dec 4. [Epub ahead of print].
- Ross PS et al. (2000). High PCB concentrations in free-ranging Pacific killer whales, *Orcinus orca*: effects of age, sex and dietary preference. *Marine Pollution Bulletin*, 40(6):504–515.
- Ross PS et al. (2012). Declining concentrations of PCBs, PBDEs, PCDEs and PCNs in harbor seals from the Salish Sea. *Progress in Oceanography*, in press.
- Skakkebaek NE et al. (2011). The exposure of fetuses and children to endocrine disrupting chemicals: a European Society for Paediatric Endocrinology (ESPE) and Pediatric Endocrine Society (PES) call to action statement. *Journal of Clinical Endocrinology and Metabolism*, 96(10):3056–3058.
- UNEP/WHO (2012). *State of the science of endocrine disrupting chemicals—2012*. Geneva, Switzerland, United Nations Environment Programme/World Health Organization.
- Zhang P et al. (2010). Global healthcare expenditure on diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, 87(3):293–301.



Endocrine Disrupting Chemicals have many sources



**World Health
Organization**

For more information, contact:

Public Health and Environment Department (PHE)
Health, Security & Environment Cluster (HSE)
World Health Organization
Avenue Appia 20
CH-1211 Geneva 27, Switzerland
www.who.int/phe/en/
WHO/HSE/PHE/IHE/2013.1

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, 00100 Kenya
Tel: (254 20) 7621234
Fax: (254 20) 7623927
E-mail: uneppub@unep.org
web: www.unep.org



UNEP

For more information, contact:

UNEP/DTIE, Chemicals Branch
United Nations Environment Programme
11-13 Chemin des Anémones
CH-1219 Châtelaine,
Geneva, Switzerland
E-mail: chemicals@unep.org
www.unep.org/hazardoussubstances

Job Number: DTI/1554/GE

TAB N

Chemical odor, kids' nosebleeds, few answers in South L.A. neighborhood

An oil pumping operation in South L.A., newly ramped up after years of dormancy, has neighbors worried despite officials' assurances.

September 21, 2013 | By Louis Sahagun

Monic Uriarte says she began having headaches and bouts of dizziness three years ago, about the time she and her neighbors began smelling a chemical odor on the streets and in their homes.

Then Uriarte's 9-year-old daughter and other children in the University Park neighborhood of South Los Angeles began suffering from recurring nosebleeds and respiratory ailments.

After a little sleuthing, Uriarte and others traced the smell to property shielded from the neighborhood by a 12-foot-high, ivy-covered wall. Behind it, on land leased from the Catholic Archdiocese of Los Angeles, Allenco Energy Inc. had ramped up production from an oil field by more than 400% — from 4,178 barrels in 2009 to 21,239 in 2010, according to the state Division of Oil, Gas & Geothermal Resources.

Residents of the low-income community complained to state air quality officials 251 times over the next three years — up from just eight complaints from University Park in 2008-09. The South Coast Air Quality Management District responded by issuing 15 citations against Allenco for foul odors.

The district insists that based on its air sampling, the odors are harmless and pose no health risk. Instead, the issue "boils down to incompatible zoning decisions," said Mohsen Nazemi, the district's deputy field officer for engineering and compliance.

James Dahlgren, a toxicology expert and former assistant professor of clinical medicine at UCLA, does not agree. Dahlgren is investigating the complaints of illness on behalf of the Esperanza Community Housing Corp., which uses public and private funds to build affordable housing projects in the University Park area.

Dahlgren said the odors cannot be dismissed as harmless. "If you can smell it, it's not safe," he said. "These people are experiencing symptoms."

Allenco refused to comment about its operation.

University Park is not alone in its concerns about living near newly invigorated wells. High prices for crude oil and new extraction technologies are driving a revival of urban oil fields across Southern California. Some neighborhoods are pushing back.

In Baldwin Hills, residents near the Inglewood Oil Field want to know if structural damage to their homes was caused by drilling. In Culver City, a venting of fumes over homes triggered a class-action lawsuit. In Whittier, residents are fighting plans to resume oil production on land set aside as a nature sanctuary.

"We're seeing people beginning to demand more action from regulatory agencies and industry when it comes to their health and safety," said Angela Johnson Meszaros, general counsel with the Los Angeles chapter of Physicians for Social Responsibility. "They're tired of being told that everything is fine."

The Allenco site is about half a mile north of the USC campus, surrounded by affordable housing projects and schools, including the Doheny Campus of Mount St. Mary's College. The site was given to the archdiocese in the 1950s by descendants of Edward L. Doheny, one of Los Angeles' early oil barons.

Today, Allenco's operations are kept behind brick walls, shaded by oak trees and fringed with manicured lawns.

U.S. Energy Department records show that all 21 wells at the site had been idled in the 1990s because of low oil prices and calcification. As part of a project cosponsored by the Energy Department, hydrochloric and phosphoric acid was used to unplug five of the wells in 2005. California records show that seven to 10 wells are now active.

Signs on gates at the site provide emergency telephone numbers but no information about the nature of the facility. Behind the walls, the roughly two-acre site bristles with pipes, tanks and gauges. The pumps are beneath the surface.

A sign inside the walls warns: "Danger: H₂S. Poisonous Gas." No such signs are posted outside the site, which is a few yards from schools and homes.

H₂S is hydrogen sulfide, a colorless, flammable gas that occurs naturally in petroleum and natural gas. Exposure to it triggers symptoms consistent with some of the complaints from the neighborhood. Repeated exposure can cause severe eye and respiratory irritation, headache, dizziness and vomiting, according to the federal Occupational Safety and Health Administration.

Sam Atwood, a spokesman for the air quality management district, said the agency has taken three air samples at the Allenco site and in the surrounding neighborhood. The samples, all from 2011, showed extremely low levels of H₂S, and low levels of other noxious gases such as carbonyl sulfide.

However, a sample taken from a wastewater tank discharge line on Aug. 29, 2011, detected levels of hydrocarbons from volatile petroleum products that were 10,000 times higher than ambient levels, according to air quality district lab reports. Although some hydrocarbons are toxic, the analyses did not identify the hydrocarbons in the sample or determine how long they had been leaking into the air.

Separately in 2011, the air district ordered Allenco to pay to move Mount St. Mary's College air-conditioning intake vents that were near the oil site. Students

and faculty had complained that foul odors from the vents lingered for hours in classrooms.

The air district did not notify the neighborhood about the change because the odors "were never considered a health threat (i.e. one that could cause permanent harm)," Atwood said in a written statement.

"Foul odors can be extremely objectionable, cause symptoms such as headaches and nausea and significantly impact residents' quality of life, especially if they are present on an ongoing basis," Atwood wrote. "That's why SCAQMD takes complaints of foul odors seriously."

The executive director of the air quality management district, Barry Wallerstein, ventured to the Allenco site last week for a brief visit and a personal sniff test.

"I was there for about 20 minutes and I had a hard time detecting anything in the air," Wallerstein said. Nonetheless, he added, "I'm going to ask our staff to take more air samples. I am also going to set up and attend a community meeting."

As concerns mount, some residents have decided to move away. Sabino Valencia, a 37-year-old machinist, has lived in the neighborhood for 22 years but doesn't think it's safe anymore for his five children. Two of them have nosebleeds nearly every day, he said.

"My doctor says my sons' nosebleeds may be happening because we live across the street from that oil field," Valencia said. "We have friends around here whose children also suffer from nosebleeds."

On a recent Wednesday night as the family was preparing for bed, Sabino's 21/2-year-old son Jonathan had a nosebleed that dripped on the living room floor.

Uriarte's daughter, now 12, also still suffers from nosebleeds.

"Something is wrong in our neighborhood," Uriarte said. "We want answers."

louis.sahagun@latimes.com

TAB O

Health Effects of Diesel Exhaust



A fact sheet by
Cal/EPA's Office of Environmental Health Hazard Assessment and
The American Lung Association of California.



Diesel fuel is widely used throughout our society. It powers trucks that deliver products to our communities, buses that carry us to school and work, agricultural equipment that plants and harvests our food, and backup generators that can provide electricity during emergencies. It is also used for many other applications. Diesel engines have historically been more versatile and cheaper to run than gasoline engines or other sources of power. Unfortunately, the exhaust from these engines contains substances that can pose a risk to human health.

In 1998, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) completed a comprehensive health assessment of diesel exhaust. This assessment formed the basis for a decision by the California Air Resources Board (ARB) to formally identify particles in diesel exhaust as a toxic air contaminant that may pose a threat to human health. The American Lung Association of California (ALAC) and its 15 local associations work to prevent lung disease and promote lung health. Since 1904, the American Lung Association has been fighting lung disease through education, community service, advocacy and research.

This fact sheet by OEHHA and ALAC provides information on health hazards associated with diesel exhaust.

**Diesel exhaust
contains more
than 40 toxic air
contaminants**

What is diesel exhaust?

Diesel exhaust is produced when an engine burns diesel fuel. It is a complex mixture of thousands of gases and fine particles (commonly known as soot) that contains more than 40 toxic air contaminants. These include many known or suspected cancer-causing substances, such as benzene, arsenic and formaldehyde. It also contains other harmful pollutants, including nitrogen oxides (a component of urban smog).

How are people exposed to diesel exhaust?

Diesel exhaust particles and gases are suspended in the air, so exposure to this pollutant occurs whenever a person breathes air that contains these substances. The prevalence of diesel-powered engines makes it almost impossible to avoid exposure to diesel exhaust or its byproducts, regardless of whether you live in a rural or urban setting. However, people living and working in urban and industrial areas are more likely to be exposed to this pollutant. Those spending time on or near roads and freeways, truck loading and unloading operations, operating diesel-powered machinery or

working near diesel equipment face exposure to higher levels of diesel exhaust and face higher health risks.

What are the health effects of diesel exhaust?

As we breathe, the toxic gases and small particles of diesel exhaust are drawn into the lungs. The microscopic particles in diesel exhaust are less than one-fifth the thickness of a human hair and are small enough to penetrate deep into the lungs, where they contribute to a range of health problems.

Diesel exhaust and many individual substances contained in it (including arsenic, benzene, formaldehyde and nickel) have the potential to contribute to mutations in cells that can lead to cancer. In fact, long-term exposure to diesel exhaust particles poses the highest cancer risk of any toxic air contaminant evaluated by OEHHA. ARB estimates that about 70 percent of the cancer risk that the average Californian faces from breathing toxic air pollutants stems from diesel exhaust particles.

**Diesel exhaust
increases the risk of
cancer...**

In its comprehensive assessment of diesel exhaust, OEHHA analyzed more than 30 studies of people who worked around diesel equipment, including truck drivers, railroad workers and equipment operators. The studies showed these workers were more likely to develop lung cancer than workers who were not exposed to diesel emissions. These studies provide strong evidence that long-term occupational exposure to diesel exhaust increases the risk of lung cancer. Using information from OEHHA's assessment, ARB estimates that diesel-particle levels measured in California's air in 2000 could cause 540 "excess" cancers (beyond what would occur if there were no diesel particles in the air) in a population of 1 million people over a 70-year lifetime. Other researchers and scientific organizations, including the National Institute for Occupational Safety and Health, have calculated cancer risks from diesel exhaust that are similar to those developed by OEHHA and ARB.

Exposure to diesel exhaust can have immediate health effects. Diesel exhaust can irritate the eyes, nose, throat and lungs, and it can cause coughs, headaches, light-headedness and nausea. In studies with human volunteers, diesel exhaust particles made people with allergies more susceptible to the materials to which they are allergic, such as dust and pollen. Exposure to diesel exhaust also causes inflammation in the lungs, which may aggravate chronic respiratory symptoms and increase the frequency or intensity of asthma attacks.

**... And it can cause
coughs and
aggravate asthma**

Diesel engines are a major source of fine-particle pollution. The elderly and people with emphysema, asthma, and chronic heart and lung disease are especially sensitive to fine-particle pollution. Numerous studies have linked elevated particle levels in the air to increased hospital admissions, emergency room visits, asthma attacks and premature deaths among those suffering from respiratory problems. Because children's lungs and respiratory systems are still developing, they are also more susceptible than healthy adults to fine particles. Exposure to fine particles is associated with increased frequency of childhood illnesses and can also reduce lung function in children.

Like all fuel-burning equipment, diesel engines produce nitrogen oxides, a common air pollutant in California. Nitrogen oxides can damage lung tissue, lower the body's resistance to respiratory infection and worsen chronic lung diseases, such as asthma. They also react with other pollutants in the atmosphere to form ozone, a major component of smog.

What is being done to reduce the health risks from diesel exhaust?

Improvements to diesel fuel and diesel engines have already reduced emissions of some of the pollutants associated with diesel exhaust. However, diesel exhaust is still one of the most widespread and toxic substances in California's air.

ARB's Diesel Risk Reduction Plan, when fully implemented, will result in a 75 percent reduction in particle emissions from diesel equipment by 2010 (compared to 2000 levels), and an 85 percent reduction by 2020. The plan calls for the use of cleaner-burning diesel fuel, retrofitting of existing engines with particle-trapping filters, and the use in new diesel engines of advanced technologies that produce nearly 90 percent fewer particle emissions, as well as the use of alternative fuels.

**Diesel exhaust
contributes to smog
and fine-particle
pollution**

The use of other fuels, such as natural gas, propane and electricity offer alternatives to diesel fuel. All of them produce fewer polluting emissions than current formulations of diesel fuel. As a result of ARB and local air-quality regulations, public transit agencies throughout California are using increasing numbers of passenger buses that operate with alternative fuels or retrofitted equipment.

For further information

Office of Environmental Health Hazard Assessment

1001 I Street, P.O. Box 4010, Sacramento, CA 95812-4010
(916) 324-7572
www.oehha.ca.gov

Air Resources Board

1001 I Street, Sacramento, CA 95814
(800) 363-7664
www.arb.ca.gov

American Lung Association of California

921 11th Street, Suite 700, Sacramento, CA 95814
(916) 442-4446
For your local office, call (800) LUNG-USA
www.californialung.org

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see OEHHA's web site at www.oehha.ca.gov/public_info.html.

TAB P



Jojo Pewsawang <jojo.pewsawang@lacity.org>

Jefferson Drill Site/ZA Case 17528(PA4)

1 message

Matthias Lenz <Matthias.Lenz@hillstone.com>

Fri, Nov 21, 2014 at 5:24 PM

To: "jojo.pewsawang@lacity.org" <jojo.pewsawang@lacity.org>, "councilmember.parks@lacity.org" <councilmember.parks@lacity.org>, "councilmember.wesson@lacity.org" <councilmember.wesson@lacity.org>
Cc: "niki@redeemercp.org" <niki@redeemercp.org>

Dear Zoning Administrator,

My name is Matthias Lenz, I live with my family at 2626 Dalton Avenue, a few blocks away from the Jefferson Drill site.

We strongly oppose the drilling activity at the Jefferson site, toxic acid being pumped under our homes, our children and neighbors being exposed to toxic fumes and in particular we oppose the additional wells proposed in the above referenced case.

FMOG has turned out to be a very disrespectful neighbor, with trucks blocking our friends cars and sidewalks, loud noise in a densely populated neighborhood, poor conditions of the property and unpleasant odors on a regular basis.

I urge you to request a full Environmental Impact Report on the entire site and full compliance of existing conditions during the EIR.

I strongly oppose any type of unconventional drilling in our neighborhood and I hope that you, as our elected representatives, will listen to our concerns.

Respectfully,

Matthias, Kimberly and Amelie Lenz

2626 Dalton Ave.

TAB Q

SCAQMD Complaint Report

Complaint 238195

Run Date: 1/8/2015 14:39:38

Receive By: KARLYNZ on 10/18/2013 15:59:03
Assign By: rchacon on 10/18/2013 16:08:16
Dispatch On: 10/18/2013
Team: Y
Type: ODORS

Assignment No: 1396514
Inspector: RHONDA LAUGESON (RL04)
Instruction:

Inspection Date: 10/18/2013 00:00:00
Description: STRONG GAS AND EXHAUST FUMES.

Instance Start Date:

Instance End Date:

Complainant

First Name:
Address:
Phone:

Alleged Source

Name: JEFFERSON URBAN OIL DRILLINT
Address: BUDLONG / JEFFERSON AVE, LOS ANGELES, CA 90007 (Sector WG)

Actual Source

Name: FREEPORT MCMORAN OIL & GAS (FORMER PXP) ID: 175162
Address: 1371 W JEFFERSON BLVD, LOS ANGELES, CA 90007 (Sector WG)
Facility TS: TS-15 Industrial: Crude Oil Production

Disposition

OC on 10/22/2013 13:25:30

Inspector Comment

10/18/13:

5:25 PM to 6:15 PM:

I conducted odor surveillance and detected mild petroleum odors on Budlong at Jefferson Blvd. The wind was from the west and shifted between n/w and s/w during this time. I used a RKI to monitor the fenceline of the site and did not get any background readings. I met with the complainant in front of his home, which shares the property line of the oil production site. He stated he smelled the baseline petroleum odor, but he got really strong gas and exhaust fumes likely from the new drilling equipment that was brought onsite. He stated they generally stop drilling between 6 PM and 7PM, but the site operates 24/7. I explained Rule 402, so the complainant stated he would inform more of his neighbors and give out the 800-CUT-SMOG number.

I called the emergency hotline for the facility and spoke to PXP Safety Specialist Buck Grayson and informed him of the complaint. Mr. Grayson stated he was unaware of any operations out of the ordinary, but he would follow-up with the contractor at the site.

Reviewed by C. Ragland

INSPECTOR: signature

DATE: _____

SUPERVISOR: signature

DATE: _____

TAB R

SCAQMD Complaint Report

Complaint 244264

Run Date: 1/8/2015 14:40:06

Receive By: MNUNEZ on 7/15/2014 11:54:00
Assign By: rstromar on 7/15/2014 13:24:40
Dispatch On: 7/15/2014
Team: I2
Type: ODORS
Inspection Date: 7/15/2014 00:00:00
Description: DIESEL AND PETROLEUM ODORS.

Assignment No: 1441588
Inspector: JOSE ENRIQUEZ (JE02)
Instruction:

Instance Start Date:

Instance End Date:

Complainant

First Name:
Address:
Phone:

Alleged Source

Name: OIL DRILLING
Address: 1349 W JEFFERSON BLVD, LOS ANGELES, CA 90018 (Sector WG)

Actual Source

Name: FREEPORT-MCMORAN OIL & GAS ID: 175162
Address: 1371 W JEFFERSON BLVD, LOS ANGELES, CA 90007-3438 (Sector WG)
Facility TS: TS-15 Industrial: Crude Oil Production

Disposition

NV on 10/14/2014 14:16:09

Inspector Comment

Inspection Date: 7/15/14
Time: 1230-1600
Applicable Rule(s): 402

I received nine complaints regarding both petroleum and diesel exhaust-type odors. The alleged source is Freeport McMoran Oil & Gas (Freeport), ID #175162, an oil production facility. The complaint numbers are 244262, 244264, 244266, 244267, 244269, 244270, 244271, 244273, and 244280. Note: this oil production facility lies in a residential neighborhood with homes surrounding three of its four sides.

Supervising AQ Inspector (Supervisor) Chacon called me and assigned me complaint #244262. At that time there was only one complaint reported. I arrived in the vicinity of the area at approximately 1230 hrs. I conducted brief odor surveillance of the area. I noted the weather to be sunny and the winds were from the west at 1-3 mph.

At 1235 hrs, I called the complainant from complaint #244262 and spoke with him. I asked the complainant if he could presently smell the odors that he reported and he stated that he could not because he had left the area. The complainant stated that earlier that day he smelled foul petroleum odors just north of the alleged source, right alongside the fence that separates the properties. The complainant added that he observed two tanker trucks with acid enter the facility, and that the facility was conducting an acidizing job. When I asked the complainant how he knew about the acidizing job, he stated that he obtained the information from SCAQMD's website. I stated to the complainant that I will enter and inspect the facility, and will follow up with him with my findings.

I again conducted surveillance, this time by foot on Budlong Ave., since that street was downwind from Freeport McMoran. Budlong Ave. lies adjacent to Freeport McMoran on its east side. As I walked on Budlong Ave., I detected a diesel exhaust-type odor while standing next to the facility's gate that faces Budlong Ave., a 3 on a 0-10 scale. I could see an exhaust stack belonging to a portable engine inside Freeport McMoran from Budlong Ave. I also observed exhaust stacks from two heavy duty diesel trucks.

At this point I received a total of six additional complaints, for a total of seven thus far. I spoke with Supervisor Chacon whom stated that Inspector Fujiwara would be joining me in assisting with the investigation. Inspector Fujiwara would be bringing a Toxic Vapor Analyzer (TVA) #7, a quad-gas meter, a Jerome sampler, and Rule 1176 bulbs.

At 1305 hrs, I called the complainant from complaint #244266. There was no answer so I left a voicemail with my name, that I was in the area conducting surveillance, and that I was going to enter the alleged source to conduct an inspection. I also left my office phone number so that the complainant can call me back

INSPECTOR: _____
signature

DATE: _____

SUPERVISOR: _____
signature

DATE: _____

SCAQMD Complaint Report

Complaint 244264

Run Date: 1/8/2015 14:40:06

my office phone number so that the complainant can call me back.

At 1323 hrs I called the complainant from complaint #244264. There was no answer so I left a voicemail with my name, that I was in the area conducting surveillance, and that I was going to enter the alleged source to conduct an inspection. I also left my office phone number so that the complainant can call me back.

At 1327 hrs I called the complainant from complaint #244267. There was no answer so I left a voicemail with my name, that I was in the area conducting surveillance, and that I was going to enter the alleged source to conduct an inspection. I also left my office phone number so that the complainant can call me back.

At 1330 hrs I called the complainant from complaint #244270. There was no answer so I left a voicemail with my name, that I was in the area conducting surveillance, and that I was going to enter the alleged source to conduct an inspection. I also left my office phone number so that the complainant can call me back.

At 1333 hrs I called the complainant from complaint #244269. There was no answer and I received a recording that this person's voicemail could not accept messages. I tried calling a second time and I received the same recording as before. I was not able to leave a message with this complainant.

At 1340 hrs I called the complainant from complaint #244271. I asked this complainant if she could presently smell the odor that she reported and she stated that she could not. I asked for her to describe the odor, when she smelled it, and where. The complainant replied that she smelled a diesel exhaust-type odor while walking on Jefferson Blvd. earlier that day in the morning hours. The complainant added that she was notified by a neighbor about an acidizing job that would be occurring that day at the Freeport site. The complainant also stated that this neighbor showed her a flyer with photos of two tanker trucks with acid that would be in the neighborhood, along with a warning about the acidizing project written on the flyer. I stated to the complainant that I will enter and inspect the facility, and will follow up with her with my findings.

At 1345 hrs, I entered Freeport McMoran. I met with Joseph Nichols, Operator, and with Francisco Panuco, Lead Operator. I asked what they were doing today and Mr. Panuco stated that two contractors were doing an acidizing job on well #19, a producer well, as routine maintenance/cleanout. Mr. Panuco stated that well #19 produces an average of 12 barrels of oil/day, 45 barrels of water/day, and 13 mcf of gas/day. At this point Inspector Fujiwara arrived with the monitoring and sampling equipment.

Inspector Fujiwara, Mr. Panuco, Mr. Nichols, and I walked to the acidizing job. We met with Brian Hallmark, Rig Supervisor for California Well Services, LLC, office # (805) 650-2794 ext. 120, cell # (562) 244-1467. I asked Mr. Hallmark when the acidizing job started and he stated they started at 1030 hrs earlier that day and stopped acidizing at 1230 hrs. Well washout was done by 1400 hrs. We observed that workers were disassembling the pipeline that fed acid into the well.

Mr. Hallmark stated that the acids and their quantities that were used in this well cleanout included 2000 gallons of 15% HCL, 3000 gallons of 12% HCL & 3% HF, 3000 gallons of 3% NH₄CL, and 25 barrels of lease water. Mr. Hallmark then stated that his company was working on the oil rig and that Haliburton was the company that was pumping the acids into the well. Lastly, Mr. Hallmark stated that they are done with the acidizing and cleanout work and will remove the acidizing equipment later today, and that the only remaining work is to reinsert the well tubing back into the well which will be done the next day. While standing on the northwest area of the facility, with the acidizing project directly east of me, I took a Jerome sample and obtained a reading of .004 ppm of H₂S.

We walked towards a large red-colored portable internal combustion engine (ICE) that was in operation. This large ICE is the same one I observed from outside the facility on Budlong St. and it was housed on a flat bed. We met with Ruben Cepeda, Supervisor for Haliburton, (661) 343-6040. I noted a second, smaller ICE on the same flat bed with the larger ICE; both of these engines were CARB registered. I noted the large ICE had a CARB # of 154360 with an expiration date of 5/31/17. The smaller engine had a CARB # of 154720 with an expiration date of 6/30/17. These two engines were situated very high and they were both in operation so no hour meter reading was obtained. There were minor odors of diesel exhaust around the portable ICEs but no petroleum-type odors. I took a second Jerome sample on the northeast area of the facility and obtained a reading of .003 ppm of H₂S.

Inspector Fujiwara, Mr. Panuco, Mr. Nichols, and I entered the facility's tank farm. Inspector Fujiwara scanned various components throughout the tank farm with a TVA and found a 2000 ppm VOC leak in the wastewater area from a skimmer shaft on the WEMCO unit. Inspector Fujiwara and I took a Rule 1176 bulb sample from the source of the leak. No other significant leaks were found. The quad-gas meter that was brought onto the facility did not show any elevated levels of H₂S, methane, or CO throughout the inspection.

Inspector Fujiwara and I then departed the facility.

After we departed the facility I briefly spoke with Supervisor Chacon and I relayed my findings to him. I discovered that two additional complaints were reported to SCAQMD alleging Freeport McMoran as the source. I stated to Supervisor Chacon that I will contact those complainants when I get back to the office.

INSPECTOR: _____
signature

DATE: _____

SUPERVISOR: _____
signature

DATE: _____

SCAQMD Complaint Report

Complaint 244264

Run Date: 1/8/2015 14:40:06

I arrived at my office and first contacted the complainant from complaint #244213 at 1705 hrs. I explained my findings to the complainant and the process involved in acidizing. This complainant stated that he was worried about fracking being involved in this project and I assured him that they were not fracking. Towards the end of this conversation I asked the complainant when and where he detected the alleged odors and he admitted that he never actually smelled any odors and that he was encouraged to call SCAQMD in order to have an inspector dispatched.

I then called the complainant from complaint #244280 at 1720 hrs. This complainant stated that he was driving on Jefferson Blvd. when he detected a petroleum-type odor earlier that day between 1030 hrs to 1100 hrs, and that he does not presently smell the odors. I explained my findings to the complainant and emailed him a direct link to SCAQMD's Rule 1148.2 notifications.

Date: 7/16/14

I received two voicemail messages from two complainants from yesterday's complaints. The first voicemail was from the complainant from complaint #244264. I called this complainant at 0805 hrs. The complainant stated that he smelled a gasoline-type odor yesterday on his way to work as he drove past Freeport. I explained my findings to this complainant. The complainant had a question regarding groundwater contamination relating to acidizing so I referred him to DOGGR for that question.

I then responded to the second voicemail that was from the complainant from complaint #244262. I had previously spoken with this complainant. I explained my findings with the complainant including that a sample was taken from the wastewater area of the facility. I also explained SCAQMD's Rule 402 protocol rela

INSPECTOR: signature

DATE: _____

SUPERVISOR: signature

DATE: _____

TAB S

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 Copley Drive, Diamond Bar CA 91765-1482

MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

Page 1 of 4

TO	Ed Pupka, Sr. Enforcement Manager Compliance	LABORATORY NO	<u>1419721-01</u>
		DATE RECEIVED	<u>07/16/2014</u>
SAMPLE DESCRIBED AS		FACILITY ID NO	<u>175162</u>
One 3L Bulb		REQUESTED BY	<u>Neil Fujiwara</u>
SAMPLING LOCATION		ST NO / PROJECT	<u>R 1176</u>
Freeport-McMoran Oil & Gas 1371 W Jefferson Blvd. Los Angeles, CA 90007			


Hydrocarbon speciation, excluding aromatic compounds, by cryo GC FID
(normalized to NM/NEOC)

Type	Bulb
Number	<u>04-07</u>
Pressure (Torr)	717
C ₃ , ppmv	47.9
C ₄ , ppmv	29.7
C ₅ , ppmv	14.4
C ₆ , ppmv	7.5
C ₇ , ppmv	8.6
C ₈ , ppmv	5.7
C ₉ -C ₁₂ , ppmv	15.6

Note: The reported values include BTEX (benzene, toluene, ethylbenzene and xylenes).

Date Approved: 9/12/14

Approved By: _____


Rudy Eden, Senior Manager
Laboratory Services
909-396-2391

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 Copley Drive, Diamond Bar CA 91765-1482

MONITORING & ANALYSIS
REPORT OF LABORATORY ANALYSIS

Page 2 of 4

SAMPLE DESCRIBED AS

LABORATORY NO

1419721-01

One 3L Bulb

REQUESTED BY

Neil Fujiwara

Benzene, Toluene, Ethylbenzene, and Xylenes, by cryo GC FID
(normalized to NM/NEOC)

Type	Bulb
Number	<u>04-07</u>
Pressure (Torr)	717

Benzene, ppmv	0.6
Toluene, ppmv	0.8
Ethylbenzene, ppmv	0.2
m+p-Xylenes, ppmv	0.9
o-Xylene, ppmv	0.1

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 Copley Drive, Diamond Bar CA 91765-1482

MONITORING & ANALYSIS
QUALITY CONTROL SUMMARY

Page 3 of 4

SAMPLE DESCRIBED AS	LABORATORY NO	<u>1419721-01</u>
One 3L Bulb	REQUESTED BY	<u>Neil Fujiwara</u>

**Hydrocarbon speciation and benzene, toluene and xylenes by cryo GC FID,
normalized to NM/NEOC.**

QUALITY CONTROL -- End of run control recovery

		Theoretical	Measured	Percent Difference	QC Limit ±7.5%
CC318590	MDL				
Methane, ppmv	0.5	NA	NA	NA	NA
Ethylene, ppmv	0.2	5.03	5.275	4.87	PASS
Ethane, ppmv	0.2	NA	NA	NA	NA
Propane, ppmv	0.1	3	3.063	2.10	PASS
Isobutane, ppmv	0.2	3.1	3.078	-0.71	PASS
n-Butane, ppmv	0.1	3.03	2.982	-1.58	PASS
Isopentane, ppmv	0.1	2.02	2.05	1.49	PASS
n-Pentane, ppmv	0.1	2.01	2.019	0.45	PASS
Hexane, ppmv	0.1	2.02	2.102	4.06	PASS
Heptane, ppmv	0.1	1.02	1.012	-0.78	PASS
Octane, ppmv	0.1	1.01	0.96	-4.95	PASS

Note: QC limit for heptane and octane is 15%

		Theoretical	Measured	Percent Difference	QC Limit ±7.5%
CC318590					
Benzene, ppmv	0.2	5.03	5.149	2.37	PASS
Toluene, ppmv	0.1	1.01	0.98	-2.97	PASS
Ethylbenzene, ppmv	0.1	1.01	1.07	5.94	PASS
m+p-Xylene, ppmv	0.1	1.014	0.977	-3.65	PASS
o-Xylene, ppmv	0.1	1.01	1.036	2.57	PASS

DATE ANALYZED	7/28/2014
REFERENCE NO:	14FI4AB
	FI4-62-91

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 Copley Drive, Diamond Bar CA 91765-1482

MONITORING & ANALYSIS
QUALITY CONTROL SUMMARY

Page 4 of 4

SAMPLE DESCRIBED AS	LABORATORY NO	<u>1419721-01</u>
One 3L Bulb	REQUESTED BY	<u>Neil Fujiwara</u>

**Hydrocarbon speciation and benzene, toluene and xylenes by cryo GC FID,
normalized to NM/NEOC.**

QUALITY CONTROL -- End of run control recovery

			Theoretical	Measured	Percent Difference	QC Limit ±7.5%
CC89578	MDL					
Methane, ppmv	0.5		10930	10948	0.16	PASS
Ethylene, ppmv	0.2		5080	5089	0.19	PASS
Ethane, ppmv	0.2		5180	5211	0.60	PASS
Propane, ppmv	0.1		3400	3411	0.33	PASS
Isobutane, ppmv	0.2		2509	2520	0.44	PASS
n-Butane, ppmv	0.1		2412	2421	0.39	PASS
Isopentane, ppmv	0.1		1958	1967	0.44	PASS
n-Pentane, ppmv	0.1		1862	1871	0.50	PASS
Hexane, ppmv	0.1		1572	1583	0.72	PASS
Heptane, ppmv	0.1		379	386	1.75	PASS
Octane, ppmv	0.1		89.2	92.5	3.70	PASS

Note: QC limit for heptane and octane is 15%

			Theoretical	Measured	Percent Difference	QC Limit ±7.5%
CC89578						
Benzene, ppmv	0.2		691	703	1.69	PASS
Toluene, ppmv	0.1		85.7	87.8	2.50	PASS
Ethylbenzene, ppmv	0.1		46.1	47.6	3.15	PASS
m+p-Xylene, ppmv	0.1		46	49.4	7.38	PASS
o-Xylene, ppmv	0.1		33.6	35.4	5.43	PASS

DATE ANALYZED	7/28/2014
REFERENCE NO:	14FI4AB
	FI4-62-91

**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
SAMPLE ANALYSIS REQUEST**

☐ DISTRI
☐ INVOIC
LABORA

WO #: 1419721



TO: SCAQMD LAB: X OTHER: ☐

SOURCE NAME: Freeport-McMoran Oil & Gas I.D. No. 175162

Source Address: 1371 W Jefferson Blvd. City: Los Angeles

Mailing Address: 5640 S Fairfax Ave City: Los Angeles Zip: 90056

Contact Person: Pat Gorski Title: Senior EH&S Analyst Tel: 323.298.2441

Analysis Requested by: Neil Fujiwara Date: 7/16/2014

Approved by: *Godolfo Chacon* RCIO Office: Compliance Budget #: 50-375

REASON REQUESTED: Court/Hearing Board ☐ Permit Pending ☐ Hazardous/Toxic Spill ☐

Suspected Violation X Rule(s) R1176 Other ☐

Sample Collected by: Neil Fujiwara Date: 07/15/2014 Time: 1520 hrs.

1. Bulb 04-07: Taken at the skimmer shaft of the WEMCO unit leaking 2000 ppm

Analysis Requested: NMHC Concentration and Methane concentration per SCAQMD Method 25.1

Relinquished by	Received by	Firm/Agency	Date	Time
Neil Fujiwara	<i>Gale Jones</i>	SCAQMD	7/16/14	730
<i>Gale Jones</i>	<i>John</i>	SCAQMD LAB	7/16/14	821

Remarks: Please expedite and provide results to Edwin Pupka, Manager

**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
21865 Copley Drive, Diamond Bar, CA 91765-1482**

**MONITORING & ANALYSIS
VALUE OF ANALYSIS**

SOURCE NAME

Freeport-McMoran Oil & Gas
1371 W Jefferson Blvd.
Los Angeles, CA 90056
One 3L Bulb

LABORATORY NO 1419721-01

Analysis Value Summary per Rule 304.1

# Samples	# Compounds	Analysis Type: GC FID	OT/Expedited Unit Value	Ext. Cost
1		GC Analysis (Quantification)	314.36	314.36
1	7	GC Additional Compounds (Quantification)	37.30	261.10

Total Value \$575.46

TAB T



NATURAL RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS & GEOTHERMAL RESOURCES
5816 Corporate Ave., Suite 200 Cypress, CA 90630 - 4731

PERMIT TO CONDUCT WELL OPERATIONS

Waterflood
JEFFERSON ZONE, JEFFERSON AREA

No. **P 114-0402**

Old	New
382	382
FIELD CODE	
09	09
AREA CODE	
05	05
POOL CODE	

Cypress, California
May 29, 2014

Mr. Kenneth R. Bork, Agent
Freeport-McMoRan Oil & Gas LLC (P3875)
1200 Discovery Drive, Suite 500
Bakersfield, CA 93309

Your proposal to **Rework** well "**Jefferson**" **21**, A.P.I. No. **037-02026**, Section **1**, T. **02S**, R. **14W**, **SB B. & M., Las Cienegas** field, **Jefferson** area, **Jefferson, Jefferson Block** pool, **Los Angeles** County, dated **5/27/2014**, received **5/27/2014** has been examined in conjunction with records filed in this office. (Lat: **34.026312** Long: **-118.296646** Datum: **83**)

THE PROPOSAL IS APPROVED PROVIDED:

1. Blowout prevention equipment, as defined by this Division's publication No. M07, shall be installed and maintained in operating condition and meet the following minimum requirements:
 - a. Class **II2M**, with hydraulic controls, on the **7"** casing.
 - b. A **2M lubricator** for **wireline** operations.
2. Blowout prevention practice drills are conducted at least weekly and recorded on the tour sheet. A practice drill may be required at the time of the test/inspection.
3. Hole fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts shall be used.
4. Sufficient material to control lost circulation of hole fluid shall be available for immediate use at the well site.
5. A diligent effort shall be made to clean out to **4228'**.
6. A pressure test is conducted on the **7"** casing. If leaks are found, locate holes and contact engineer.
7. The **5 1/2"** casing is cemented with sufficient cement to fill behind the casing from **4228' to 1670' (top of 5 1/2" casing)**.
8. A **radial cement evaluation tool** shall be run from **4228' to 1670' (top of 5 1/2" casing)**.
9. Prior to shooting any perforations, a pressure test of the **5 1/2"** casing shall be made to ensure casing integrity. If casing integrity is not demonstrated, a retainer or packer is required for squeeze operations.
10. Injection is through tubing with packer set in cemented casing immediately above the approved zone of injection.
11. Prior to commencing injection, and every **5** years thereafter, a pressure test is conducted to demonstrate the mechanical integrity of the **5 1/2"** casing. The minimum test pressure shall be **1312** psi.

Continued on Page 2

Blanket Bond
UIC Project No. 38209001
cc:

Engineer Barry Irick
Office (714) 816-6847

BI/bi

Pat Perez
Acting State Oil and Gas Supervisor

By 
For: Daniel J. Dugak, District Deputy

A copy of this permit and the proposal must be posted at the well site prior to commencing operations. Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended. Issuance of this permit does not affect the Operator's responsibility to comply with other applicable state, federal, and local laws, regulations, and ordinances.

12. Within **90** days of commencing injection, and every **24** months thereafter, this Division shall be furnished with an injection survey that demonstrates the confinement of the injected fluid to the approved zone of injection, and the mechanical integrity of the injection tubing and packer.
13. The maximum allowable surface injection pressure for this well shall not exceed **1312** psi. Under no circumstances shall the injection gradient exceed **0.9** psi/ft.
14. No program changes are made without prior Division approval.
15. **THIS DIVISION SHALL BE NOTIFIED TO:**
 - a. Inspect the installed blowout prevention equipment prior to commencing **downhole** operations.
 - b. Witness a pressure test of the **7"** casing.
 - c. Review the results of the **radial cement evaluation tool** prior to continuing operations.
 - d. Witness a pressure test of the **5 1/2"** casing prior to commencing injection, and every **5** years thereafter.
 - e. Witness the running of an injection survey within **90** days of commencing injection, and every **2** years thereafter.

NOTE:

1. Hydrogen sulfide gas (H₂S) is known to be present in this area, adequate safety precautions shall be taken prior to and during well operations.
2. The base of the freshwater zone is at **650'±**.
3. The required History of Oil or Gas Well (OG103) shall include a complete description of the required pressure test.
4. No operation shall be undertaken or continued that will contaminate or otherwise damage the environment.
5. Upon completion of the proposed work, a Well Summary Report (form OG100), a History of Oil or Gas Well (form OG103), and copies of all logs, tests, and surveys shall be submitted to this office.
6. Any well stimulation conducted after January 1, 2014 will be subject to Senate Bill 4, (Chapter 313, 2013 Statute) requirements.



NATURAL RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

P#114-0402

5/BI

FOR DIVISION USE ONLY		
	Forms	
Bond	OGD114	OGD121
BB	5/31/14	05/27/14 DT

NOTICE OF INTENTION TO REWORK / REDRILL WELL

Detailed instructions can be found at: www.conservation.ca.gov/dog/

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to

rework ☒ / redrill ☐ well Jefferson 21, API No. 04037020260000
(Check one)

Sec. 1, T. 2S, R. 14W, SB B.&M., Las Cienegas Field, Los Angeles County

The complete casing record of the well (present hole), including plugs and perforations, is as follows: (Attach wellbore schematics diagram also.)

Conductor 20", 12 - 62', , cemented @ 12' - 62'; Surface 10.75", 12 - 926', 41# J-55, cemented @ 12' - 926'; Production ST1 7", 12 - 5151', 26# J-55, cemented @ 3525' - 3550'; 3036' - 3066'; 1686' - 1717'; 3099' - 3130'; 3223' - 3130'; 2840' - 5151' Plugs @ 4228' - 4240' & 4632' - 4637'

7" perf'd @ 4208' - 3694'

Fish @ 4264' - 4632'; Cement Retainer @ 4240' - 4242'

The total depth is: 5495 feet.

The effective depth is: 4228 feet.

Present completion zone(s): Puente; J20, J30
(Name)

Anticipated completion zone(s): Same
(Name)

Less than
Present zone pressure: hydrostatic psi.

Less than
Anticipated/existing new zone pressure: hydrostatic psi.

Is this a critical well as defined in the California Code of Regulations, Title 14, Section 1720(a) (see next page)? Yes ☒ No ☐

For redrilling or deepening only, is a California Environmental Quality Act (CEQA) document required by a local agency?
Yes ☐ No ☐ If yes, see next page.

The proposed work is as follows: (A complete program is preferred and may be attached.)

Repair casing. Please see attached Program.

If well is to be redrilled or deepened, show proposed coordinates (from surface location) and true vertical depth

at total depth: _____ feet _____ and _____ feet _____ Estimated true vertical depth: _____
(Direction) (Direction)

Will the Field and/or Area change? Yes ☐ No ☒ If yes, specify New Field: _____ New Area: _____

The Division must be notified immediately of changes to the proposed operations. Failure to provide a true and accurate representation of the well and proposed operations may cause rescission of the permit.

Name of Operator
Freeport-McMoRan Oil & Gas LLC

Address <u>5640 South Fairfax Avenue</u>		City/State <u>Los Angeles, CA</u>	Zip Code <u>90056</u>
Name of Person Filing Notice <u>Gerry L. Cales</u>	Telephone Number: <u>323-298-2226</u>	Signature <u>Gerry L. Cales</u>	Date <u>05/23/2014</u>
Individual to contact for technical questions: <u>Mike Fernandez</u>	Telephone Number: <u>323-298-2276</u>	E-Mail Address: <u>Mike_Fernandez@fmi.com</u>	

This notice must be filed, and approval given, before the operations begin. If operations have not commenced within one year of the Division's receipt of this supplementary notice, this notice will be considered cancelled.

MAY 28 2014

INFORMATION FOR COMPLIANCE WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970 (CEQA)

If an environmental document has been prepared by the lead agency, submit a copy of the **Notice of Determination** or **Notice of Exemption** with this notice. Please note that a CEQA determination by a local jurisdiction, if required, must be complete, or the division may not issue a permit.

CRITICAL WELL DEFINITION

As defined in the California Code of Regulations, Title 14, Section 1720 (a), "Critical wells" means a well within:

- (1) 300 feet of the following:
 - (A) Any building intended for human occupancy that is not necessary to the operation of the well; or
 - (B) Any airport runway.
- (2) 100 feet of the following:
 - (A) Any dedicated public street, highway or the nearest rail of an operating railway that is in general use;
 - (B) Any navigable body of water or watercourse perennially covered by water;
 - (C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground or any other area of periodic high-density population; or
 - (D) Any officially recognized wildlife preserve.

WELL OPERATIONS REQUIRING BONDING

- 1. Drilling, redrilling, or deepening any well.
- 2. Milling out or removing a casing or liner.
- 3. Running and cementing casing or tubing.
- 4. Running and cementing liners and inner liners.
- 5. Perforating casing in a previously unperforated interval for production, injection, testing, observation, or cementing purposes.
- 6. Drilling out any type of permanent plug.
- 7. Reentering an abandoned well having no bond.

**Freeport McMoRan Oil & Gas
Jefferson 21
Repair Casing**

April 15, 2014
Revised April 17, 2014

PURPOSE

Repair 7" casing and install an inner string.

OTHER INFORMATION

- Will need a mud pump and Baker tank on location for returns.

NOTE: Prior to implementing well work, have a pre-spud to discuss potential concerns, job procedures, equipment, scheduling with rig supervisor, vendors and engineering.

NOTE: A Safety Meeting shall be held at the job site prior to commencing work with FM O&G Supervisor, all involved contract personnel, and appropriate personnel to discuss job details.

WARNING: Beware of the potential of hydrogen sulfide gas (H₂S) and its inherent dangers while performing well work and take the appropriate safeguards for dealing with H₂S gas.

DOGGR Regulatory Compliance

- Reasonable effort will be made to comply with all requests of the DOGGR Field Inspector.
- Minimum 2 hour notification to DOGGR for inspector to be on location.
- Every effort will be made to be ready for inspection upon arrival of the DOGGR inspector.
- All DOGGR well site inspections will be recorded on FM O&G Daily Drilling/Workover Report. Record to include name of Inspector, date, time and whether the activity was witnessed or waived by the field inspector.
- If any time differences occur between FM O&G Well Site Supervisor and DOGGR Field Inspector, operations will be suspended and each representative will consult with their respective supervisor. Job will remain shut down until DOGGR and FM O&G supervisors have discussed the issue and come to appropriate resolution.

FM O&G Personnel**Workover and Completions:**

Mike Fernandez (323) 298-2276 (office), (323) 855-1001 (cell)
Sergio Dominguez (323) 371-5821 (cell)
Brendan Dempsey (310) 251-0091 (cell)

Production Operations:

Robert Hurkmans (805) 709-8305 (cell)

TAB U

Table of Chemical Constituents Commonly Found in Crude Oil

This information is for environmental exposures. These constituents are present to some degree in all crude oil. Different types of oil, like light sweet crude oil, have different levels of these chemicals. If reported data indicate specific public health risks, CDC will develop and publish recommended steps to stop or reduce exposure.

Additional constituents may be added to this list as needed. For information on constituents of crude oil not listed here, go to: http://www.osha.gov/dts/osta/otm/otm_iv/otm_iv_2.html

The cancer value for benzene is based on one excess cancer case in one million over a lifetime of exposure. For a complete toxic profile of each chemical in this chart, go to <http://www.atsdr.cdc.gov/toxprofiles/index.asp>

Chemical	What is being done to monitor exposures?	Routes of exposure and absorption	Acute (immediate) health risks	Chronic (long-term) health risks	Comparison Values: safe level for humans ^{1, 2, 3}	How to protect against exposure
Benzene Colorless, sweet-smelling liquid and vapor. Evaporates very quickly and dissolves slightly in water.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Benzene vapors, (or fumes) can be inhaled and benzene can be consumed in contaminated food or water. It can also be absorbed through the skin. Benzene does not accumulate in significant amounts in the body.	Eating or drinking highly-contaminated food or water can cause vomiting, stomach irritation, dizziness, sleepiness, convulsions, rapid heart rate, and death. Inhaling low levels of benzene can irritate eyes, nose, throat and skin. People with chronic diseases such as asthma may be more sensitive to fumes.	Long-term exposure can adversely affect bone marrow and cause anemia, leukemia and death.	In Air: 10 ug/m ³ Chronic; 0.1 ug/m ³ Cancer. In liquids: 5 ug/l Chronic; 0.6 ug/l Cancer. In Soil: 30 mg/kg Chronic; 10 mg/kg Cancer.	If benzene is released into the air, leave the area. Avoid contact with contaminated water, soil or sediment.
Hydrogen sulfide Hydrogen sulfide is a poisonous, flammable, colorless gas that smells like rotten eggs. People usually can smell hydrogen sulfide at very low concentrations in air.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Hydrogen sulfide can be inhaled or absorbed through the skin. In the body, hydrogen sulfide is primarily converted to sulfate and is excreted in the urine. Hydrogen sulfide is rapidly removed from the body.	Inhaling low levels concentrations of hydrogen sulfide can irritate the eyes, nose, or throat. People with chronic diseases such as asthma may have trouble breathing. Brief exposure to concentrations of hydrogen sulfide greater than 500 ppm can cause loss of consciousness. In many cases where people are removed from the exposure immediately, they regain consciousness without any other effects.	Chronic exposure to high levels may cause long-term or permanent effects including headaches, impaired attention span, memory, or motor function.	In Air: No health effects have been found in humans exposed to typical environmental concentrations of hydrogen sulfide 0.2 -0.5 ug/m ³).	If hydrogen sulfide is released into the air, leave the area. Avoid contact with contaminated water, soil or sediment. Because the gas is heavier than oxygen, it hangs at low levels in the air, closer to the ground.

¹ The Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer health effects over a specified duration of exposure. The information in this MRL serves as a screening tool to help public health professionals decide where to look more closely to evaluate possible risk of adverse health effects from human exposure. ² Measures are calculated as ug(micrograms)/m³(meters cubed) in air; ug(micrograms)/(liter) in water; mg(milligrams)/kg(kilograms) in soil. ³ All comparison values in this table were calculated by the Agency for Toxic Substances and Disease Registry. The calculations for cancer values are based on National Academy of Sciences (NAS) assessment methods.

Table of Chemical Constituents Commonly Found in Crude Oil

This information is for environmental exposures. These constituents are present to some degree in all crude oil. Different types of oil, like light sweet crude oil, have different levels of these chemicals. If reported data indicate specific public health risks, CDC will develop and publish recommended steps to stop or reduce exposure.

Additional constituents may be added to this list as needed. For information on constituents of crude oil not listed here, go to: http://www.osha.gov/dts/osta/otm/otm_iv/otm_iv_2.html

The cancer value for benzene is based on one excess cancer case in one million over a lifetime of exposure. For a complete toxic profile of each chemical in this chart, go to <http://www.atsdr.cdc.gov/toxprofiles/index.asp>

Chemical	What is being done to monitor exposures?	Routes of exposure and absorption	Acute (immediate) health risks	Chronic (long-term) health risks	Comparison Values: safe level for humans ^{1, 2, 3}	How to protect against exposure
Ethyl benzene Ethyl benzene is a colorless liquid. It is highly flammable and smells like gasoline. It is naturally found in coal tar and petroleum.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Ethyl benzene can be inhaled, absorbed through the skin, or ingested in contaminated water.	Exposure to high levels of ethyl benzene in air for short periods can irritate eyes and throat. Exposure to higher levels can cause dizziness or vertigo.	Long term exposure has not been studied in humans.	In air: 3,000 ug/m3 In water: 1,000 ug/l In soil: 5,000 ug/kg	If ethyl benzene is released into the air, leave the area. Avoid contact with contaminated water.
Toluene aka Methylbenzene Toluene is a clear, colorless liquid and vapor that smells like gasoline. Toluene occurs naturally in crude oil.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Toluene can be inhaled, absorbed through the skin, or ingested in contaminated water.	Short term exposure to low to moderate levels can cause tiredness, confusion, weakness, impaired memory or motor control, nausea, loss of appetite, loss of hearing and color vision. Inhaling high levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness and may be fatal.	Long term exposure to toluene may affect the nervous system or kidneys.	In air: 300 ug/m3 In water: 200 ug/l In soil: 1,000 mg/kg	If toluene is released into the air, leave the area. Avoid contact with contaminated water, soil, or sediment.
Xylene Xylene is a colorless, sweet-smelling liquid and vapor. It is highly flammable and evaporates easily. It occurs naturally in petroleum and coal tar.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Xylene can be inhaled, ingested in contaminated water and absorbed through the skin.	Short term exposure to high levels can cause headaches, lack of coordination, dizziness, confusion, and impaired balance. Such exposure can also irritate skin, eyes, nose, throat and stomach. Other symptoms may include breathing difficulties, especially in those with chronic lung problems. At very high levels, exposure may cause unconsciousness and death.	Symptoms may include impaired reaction time, concentration and memory, and changes in the liver and kidneys.	In air: 3,000 ug/m3 In water: 2,000 ug/l In soil: 10,000 mg/kg	If xylene is released into the air, leave the area. Avoid skin contact with tar, gasoline, paint varnish, shellac and contaminated water.

¹ The Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer health effects over a specified duration of exposure. The information in this MRL serves as a screening tool to help public health professionals decide where to look more closely to evaluate possible risk of adverse health effects from human exposure. ² Measures are calculated as ug(micrograms)/m3(meters cubed) in air; ug(micrograms)/(liter) in water; mg(milligrams)/kg(kilograms) in soil. ³ All comparison values in this table were calculated by the Agency for Toxic Substances and Disease Registry. The calculations for cancer values are based on National Academy of Sciences (NAS) assessment methods.

Table of Chemical Constituents Commonly Found in Crude Oil

This information is for environmental exposures. These constituents are present to some degree in all crude oil. Different types of oil, like light sweet crude oil, have different levels of these chemicals. If reported data indicate specific public health risks, CDC will develop and publish recommended steps to stop or reduce exposure.

Additional constituents may be added to this list as needed. For information on constituents of crude oil not listed here, go to: http://www.osha.gov/dts/osta/otm/otm_iv/otm_iv_2.html

The cancer value for benzene is based on one excess cancer case in one million over a lifetime of exposure. For a complete toxic profile of each chemical in this chart, go to <http://www.atsdr.cdc.gov/toxprofiles/index.asp>

Chemical	What is being done to monitor exposures?	Routes of exposure and absorption	Acute (immediate) health risks	Chronic (long-term) health risks	Comparison Values: safe level for humans ^{1, 2, 3}	How to protect against exposure
Naphthalene and Methyl-naphthalene Naphthalene is a colorless to white or brown solid or vapor that smells like mothballs. It evaporates quickly and dissolves in water. 1-Methyl-naphthalene is a clear liquid and 2-Methyl-naphthalene is a solid.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Naphthalene can be inhaled, absorbed through the skin, or ingested through contaminated water.	Exposure to high levels of naphthalene can cause nausea, vomiting, diarrhea, blood in urine, rash and yellow skin. Exposure to extremely elevated levels (500 ppm) of airborne naphthalene can be fatal.	Long term exposure has been linked to hemolytic anemia, a disorder of red blood cells. Symptoms of this anemia include fatigue, lack of appetite, restlessness, and pale skin.	In air: 3 ug/m ³ In water: 700 ug/l In soil: 700 ug/kg	If the concentration rises above (~1300 mg/m ³) in the air, leave the area. Avoid contact with contaminated water, soil and sediment.
Generic alkanes (including octane, hexane, nonane) Alkanes are colorless liquids or vapors that smell like gasoline. They are present in crude oil and petroleum products. They are highly flammable and evaporate easily.	Local Poison Control Centers and Health Departments are tracking calls related to potential exposures to this chemical, and several federal agencies, including the EPA, are taking frequent air and water samples.	Alkanes can be inhaled, absorbed through the skin, or ingested in contaminated water.	Inhaling high levels of n-hexane (a specific type of medium-sized alkane), can cause numbness in the feet and hands and muscle weakness in the feet and lower legs. Inhaling high levels of some alkanes can cause asphyxiation.	Toxicity is dependent on type of alkane as well as route and duration of exposure. Long term exposure to n-hexane can cause weakness and loss of feeling in the arms and legs. In one study, exposed workers removed from the exposure site recovered in 6 months to a year.	In air: 31,000 ug/m ³ * In water: 120,000 ug/l* In soil: 600 mg/kg* *Decane and white oil	If generic alkanes are released into the air, leave the area. Avoid contact with contaminated water, soil or sediment.

¹ The Minimal Risk Level (MRL) is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer health effects over a specified duration of exposure. The information in this MRL serves as a screening tool to help public health professionals decide where to look more closely to evaluate possible risk of adverse health effects from human exposure. ² Measures are calculated as ug(micrograms)/m³(meters cubed) in air; ug(micrograms)/l(liter) in water; mg(milligrams)/kg(kilograms) in soil. ³ All comparison values in this table were calculated by the Agency for Toxic Substances and Disease Registry. The calculations for cancer values are based on National Academy of Sciences (NAS) assessment methods.

TAB V

SAFETY:**'That stuff can get you so fast' -- deadly gas on the rise in oil fields**

Mike Lee, E&E reporter

EnergyWire: Tuesday, October 21, 2014

ODESSA, Texas -- Elaine Beadle initially thought the odor creeping into her home on this city's west side was a sewer leak.

It started about the time she moved in four years ago -- a smell like rotten eggs. Sometimes it got so bad her eyes burned.

She soon learned the real source: a tank battery that collects oil and gas from wells scattered throughout the vacant land and small homes near the intersection of University Drive and Loop 338.

The gas in the tank battery contains more than 300 times the lethal level of hydrogen sulfide, a common byproduct of oil production in West Texas.

A catastrophic leak at the battery, which served the J.E. Bagley lease, would allow potentially deadly doses of the gas to drift 95 feet, and the levels would be high enough to sicken people at 200 feet. The nearest homes are perhaps 100 to 150 feet from the battery.

The tank battery's operator, Cambrian Management, said there's no danger to Beadle or her neighbors because production on the J.E. Bagley Lease is small -- 40 to 50 barrels of crude a day and small amounts of gas. The worst-case emissions event could happen only if 24 hours' worth of gas production were released at once.

SPECIAL SERIES

An investigation of the drilling industry's worker safety record and what it means for those living amid the boom. [Click here](#) to read the series.

The battery has leaked four times since 2011, according to records from the Texas Railroad Commission, which regulates oil and gas drilling in the state.

The Railroad Commission has threatened three times to shut down production from the tank battery but has relented when the owner made repairs.

"We just get a letter stating they were working on it. They said that every time, and you still smell it," Beadle said.

Living with "sour gas" is an old story in West Texas, but it's beginning to happen in more oil-producing regions as the boom in onshore drilling pushes oil production into new places. Neither the states nor the federal government tracks the amount of hydrogen sulfide production, but complaints and permitting related to hydrogen sulfide are growing in four

states, according to documents and interviews.

The gas is deadly in small amounts. It can stop a person's breathing at a concentration of 500 parts per million and render people unconscious within seconds at 700 parts per million.

There's a catch, too: As the concentration increases, the gas deadens people's sense of smell, making it hard for them to detect the danger. And if that's not enough, it can corrode steel and iron.

It has killed at least five oil field workers since the beginning of 2013 and in 1975 was responsible for one of the worst oil field accidents ever.

That has led to complaints from environmentalists, who say that state regulators aren't keeping up with the increase in sour gas production.

"More than anything else in oil and gas, hydrogen sulfide kills," said Neil Carman, clean air director of the Sierra Club's Lone Star Chapter in Texas.

Exact comparisons are difficult because each state keeps its records differently. In Kansas, state



regulators received 15 requests to flare gas containing hydrogen sulfide in 2013, up from three in 2012 and none from 2009 to 2011, state records show. Most of those cases involve the Mississippi Lime field.

Oklahoma regulators calculated that oil and gas operators emitted 594 tons of hydrogen sulfide in 2011 and are planning to do more monitoring of air emissions overall. In New Mexico, which shares patches of the sour gas-producing Permian Basin with Texas, state officials received reports of five hydrogen sulfide releases in 2013, after receiving none in 2012 and four in 2011.



Elaine Beadle stands in front of an oil field tank battery that has leaked hydrogen sulfide gas near her home in Odessa, Texas. Photo by Mike Lee.

Texas tracks the amount of gas produced in fields that also have hydrogen sulfide, although it doesn't track the actual amounts of hydrogen sulfide, and not all of the gas produced in those fields is sour. The amount of gas from hydrogen sulfide-containing fields rose 48 percent over five years, from 1.2 trillion cubic feet in 2009 to 1.7 trillion cubic feet.

The state requires special permits for oil wells, pipelines and processing plants that handle gas containing more than 100 parts per million of hydrogen sulfide. The state issued 6,906 of the permits in 2013, up 63 percent from the 4,233 it issued in 2009.

A lethal leak

Texas and most other states adopted their hydrogen sulfide regulations nearly 40 years ago after an oil field accident showed the full potential danger from the gas.

Early in the morning on Feb. 2, 1975, an Arco oil well outside Denver City, Texas, sprang a leak. The well was being injected with gas in order to increase its pressure and force out more oil. The gas contained 40,000 parts per million of hydrogen sulfide, though, and the cold air and the windless conditions allowed the gas to concentrate along the ground, according to media reports from the time.

Nine people died, including eight who had gathered at the home of J.C. Patton, a farmer who lived 150 to 200 yards from the oil well.

"That stuff can get you so fast, you don't realize you're in it till it's too late," said Jack Watkins, who was a volunteer firefighter in Denver City in 1975.

Watkins and another firefighter strapped on air packs and helped find the victims after another rescue crew's vehicle got stuck in a field, he said in an interview. He passed a dead dog on the Patton home's back porch and came upon two people, both dead, in the cab of a pickup truck. A few steps later, J.C. Patton was sprawled on the ground. Nearby, two women and two teenage girls were in a passenger car, its engine still running. A man's body had fallen partially out of the car.

"You could tell they'd been fighting this gas -- they had washcloths over their mouths," Watkins said.

The ninth victim, an Arco worker, was on his way to help with the leak when he died in his pickup by the side of a nearby highway.

In the wake of the Denver City deaths, Texas adopted [Statewide Rule 36](#). In addition to requiring [permits](#) for wells that produce hydrogen sulfide, the rule requires operators to file contingency plans in situations where a hydrogen sulfide leak could affect a populated area or a public road.

The Railroad Commission says the rules have worked well since then.

"Staff tells me anecdotally they have not had an off-lease fatality since the adoption of Statewide Rule 36,"

Gaye McElwain, a Railroad Commission spokeswoman, wrote in an email.

New wave of drilling creeps closer to homes

A few things have changed since the Texas rules were adopted. In 1975, oil production was declining in the state. Output peaked at more than 3.4 million barrels a day in 1972 and settled at just over 1 million barrels a day in the mid-2000s.

The downturn meant the Odessa area's boomtown growth slowed to a trickle. Ector County, which includes Odessa, saw its population more than double to about 91,000 people from 1950 to 1960. Between 1980 and 1992, it added 3,500 people, [according](#) to the "Handbook of Texas Online."

Starting about 2010, oil production began to rebound, as exploration companies used horizontal drilling and hydraulic fracturing to open up new fields. It turned out that the Permian Basin, already one of the most prolific oil regions in history, was sitting on several shale fields, stacked like layers in a wedding cake.

At the same time as the Wolfcamp, Spraberry and Cline shales were helping revive the Permian Basin's oil production, a few wildcatters were drilling the Eagle Ford Shale between San Antonio and Laredo.

By July, oil production in Texas had nearly tripled in five years to 3.1 million barrels a day, according to the U.S. Energy Department.

Some of the new shale fields, though, have high levels of hydrogen sulfide. Parts of the Eagle Ford field have a maximum concentration of 68,000 parts per million, 130 times the lethal level, according to Railroad Commission data.

Parts of the Wolfcamp and Spraberry fields, discovered in Ector County, have levels even higher -- 80,000 to 123,000 parts per million, according to Railroad Commission records.

And the Odessa region is growing again. Between 2010 and 2013, Ector County's population grew 8.9 percent to 149,000. Odessa and neighboring Midland were No. 2 and No. 3 on the Census Bureau's [list](#) of fastest-growing U.S. metro regions.

Similar situations are happening in Kansas and Oklahoma, where parts of the Mississippi Lime field have high levels of hydrogen sulfide.

In Oklahoma, two university students reported getting sick from hydrogen sulfide fumes while doing research on the Nature Conservancy's Tallgrass Prairie Preserve in 2012, preserve Director Bob Hamilton said.

In Kansas, the Oil Conservation Division received complaints in December from two people in Finney County who said they were being sickened by an Occidental Petroleum well that was venting gas with 800 parts per million of hydrogen sulfide.

In June, regulators discovered that gas with 130 parts per million of hydrogen sulfide was being piped directly to four homes and two business in Clark County, according to emails obtained under the state's freedom-of-information law.

Neither Oxy nor Kansas Gas was penalized for the problems, Ryan Hoffman, director of the Kansas Corporation Commission's oil and gas division, said in an interview.

Kansas bought hydrogen sulfide monitors for its 40 field inspectors last summer after two roustabouts were killed at a well site.

In November, one of the inspectors suggested to his supervisor that the commission buy more sophisticated monitors.

"With the work we do, sometimes there are wells venting in residential areas," the inspector wrote.

Danger or nuisance?

Complaints are on the rise in [Texas](#), too -- more than 30 people called the Railroad Commission to report hydrogen sulfide odors in 2013, up from 11 in 2012 and 15 in 2011.

The Railroad Commission's Midland office sent a letter to oil producers in 2012 reminding them about the state regulations that prohibit venting gas in populated areas. The advisory came after an oil company working on a Spraberry-Wolfcamp well vented gas with hydrogen sulfide onto a neighborhood, prompting residents to leave



A sign on an oilfield tank battery in Odessa, Texas, warns workers to use gas masks. Photo by Mike Lee.

Less than a half-mile from Beadle's neighborhood, a motorist reported that she was enveloped by a cloud of hydrogen sulfide when she stopped at a traffic light. The Railroad Commission found a valve stuck open on a tank battery operating by Occidental Petroleum, one of the biggest oil producers in the Permian Basin.

The Railroad Commission didn't impose a fine in either incident.

Occidental declined requests for an interview about the Kansas and Texas incidents but issued a statement saying it is committed to safety.



A warning sign at an oil field site in Hobbs, N.M. Photo by Mike Lee.

Beadle and her neighbors say the Bagley tank battery's problem illustrates how ineffective the Railroad Commission has been in policing hydrogen sulfide emissions, even after years of complaints.

"Every time I get close to getting something done, they sell it," said Bob Scott, who grew up in the neighborhood.

One of the first wells on the Bagley lease was drilled in 1937 and "shot" with 400 quarts of nitroglycerin to boost its production, according to records on file with Cambrian Management, the lease's manager. At the time, the wells were located in a rural area, but the city of Odessa has encroached on it over decades.

Several wells in the area were combined into one lease and then flooded with water in the 1960s to boost production.

The tank battery for the lease is connected by pipe to the four or five wells that are still producing. The tanks separate the oil and gas from wastewater, and the gas is either shipped out through a pipeline or burned in a flare.

Cambrian, based nearby in Midland, took over the lease in 2001.

In December 2011, a resident who lived three blocks from the tank battery complained to the Railroad Commission that fumes were giving his family headaches and causing his son's asthma to flare up. Scott complained in August 2013. In September 2013, Charles Wilson, who lives two blocks from the Beadles, called the commission, saying the smell was drifting into his home. In December 2013, Elaine Beadle's son, Rikki, called the commission.

The commission's inspectors found similar problems each time they were called out -- gas containing hydrogen sulfide was leaking from open hatches or cracks in the tanks, or because of malfunctioning equipment like the vapor recovery unit or the flare. In the December inspection, the inspectors wrote that their "personal h2s monitors alarmed on high alarm when trying to enter gate to battery."

After three of the complaints, the commission sent letters saying it would revoke Cambrian's permission to sell oil and gas from the well, a process known as a severance. The cases were dropped after Cambrian made repairs, even though the work sometimes took months.

After Wilson's complaint, the commission tried to take more extensive legal action, saying Cambrian hadn't updated its paperwork to show that the tank battery was in a sensitive area. The commission realized, though, that it had misfiled Cambrian's paperwork and dropped the action.

As of June, inspectors visiting the site found "a deffinant [sic] smell of h2s" although their monitors were no longer going off.

"With our technology that we have, they should be able to do something about the populated areas," Wilson said in an interview.

Cambrian President Alan Means, an affable Missouri native who keeps a baseball signed by the 1957 St.

Louis Cardinals in his office, said he understands the neighbors' concerns but said there's no danger -- only a nuisance.

"I'd complain, too, because it stinks," he said.

There's equipment that could neutralize the hydrogen sulfide at the wellhead, but it's too expensive, Means said. The company could also move the battery away from the homes, which would require digging up and reinstalling the pipelines connecting it to the nearby wells. But at about \$100,000, Means said he can't justify the cost.

"The tank battery was there long before the people were," he said. "They bought their houses, or rented them, knowing about it."

Calls for tougher oversight

The Railroad Commission declined interview requests. McElwain, the spokeswoman, defended its investigations in a series of emailed responses. But the real responsibility for air pollution complaints at people's homes lies with another agency, the Texas Commission on Environmental Quality, McElwain said in an email.

U.S. EPA has tried twice to tighten regulations on hydrogen sulfide, with limited success.

Hydrogen sulfide was on the original list of hazardous substances to be included in the Clean Air Act of 1990, which would have required it to be treated and monitored as an air pollutant. But it was removed before the act became law, after heavy lobbying from industry.

But in 2010, EPA moved to reinstate reporting requirements under the Toxics Release Inventory (TRI) program. TRI is a public database that is designed to provide individuals information about chemical pollutants and waste near where they live.

API, along with trade groups for paper companies and refiners, argued in 2010 that the exclusion of hydrogen sulfide from EPCRA hadn't caused any problems and said exposure to small amounts, such as 5 parts per million, haven't been shown to cause problems.

Nevertheless, EPA in 2011 reinstated the reporting requirements. But most oil and gas production facilities are exempt because they are small sources that fall below the reporting thresholds.

That leaves enforcement of hydrogen sulfide safety in the hands of state oil and gas regulators, many of whom are also tasked with promoting the industry they regulate. In Texas and Oklahoma, the regulators are elected statewide and frequently receive campaign contributions from energy companies.

Texas pursued enforcement cases against 2 percent of the 55,000 violations its oil and gas inspectors found in 2012. New Mexico's oil and gas regulation division hasn't been able to issue fines since 2009, when a court sided with an oil company that claimed only the state attorney general could pursue enforcement of oil regulations ([EnergyWire](#), July 15, 2013; [EnergyWire](#), Nov. 14, 2013).

Environmental groups say a combination of technology and tougher oversight could reduce the danger.

The Sierra Club and other environmental groups pointed to California's system of permits and monitors as a model when they pushed for EPA to tighten federal regulations. The state requires companies that emit hydrogen sulfide and other gases to run models showing whether their businesses pose a danger. If there's a

risk, the local air control district steps in and can require the company to take steps to lower the emissions. The approach has worked, since the state's network of air monitors showed a decrease in sour gas levels, according to a letter the Sierra Club and other groups sent to EPA in 2009.

In February, Colorado started requiring oil and gas companies to check for leaks at wellheads, tank batteries and other equipment using infrared cameras and fix any problems within a set period of time. The rules are intended to cut down on emissions of methane, the main ingredient in natural gas, but they would also cut down on hydrogen sulfide and other toxic chemicals associated with energy production, said Andrew Williams, a senior state regulatory affairs manager at the nonprofit Environmental Defense Fund.

In Kansas and Oklahoma, parts of the Mississippi Lime field lie on American Indian land or on land where the tribes own the mineral rights. That has led to a tangle of state and federal agencies trying to oversee oil production, said Tom Williams, a consultant for the Houston-based Environmentally Friendly Drilling Program. Solving the jurisdictional problems and making sure the agencies have the staff and training they need would help them deal with the uptick in drilling, he said.

"Regulations aren't worth a hoot when you don't have competent regulators," he said.

[Click here](#) to see the oil fields in Texas containing hydrogen sulfide and the maximum concentrations.

Reporter Mike Soraghan contributed.

Twitter: [@mikeleefw](#) | Email: mlee@eenews.net

Want to read more stories like this?

E&E is the leading source for comprehensive, daily coverage of environmental and energy politics and policy.

[Click here](#) to start a free trial to E&E -- the best way to track policy and markets.

Advertisement



The Premier Information Source for Professionals Who Track Environmental and Energy Policy.

© 1996-2016 E&E Publishing, LLC [Privacy Policy](#) [Site Map](#)

TAB W

R1148.2 (d) Notification

User Information

EForm Status COMPLETED	Date Stored 9/8/2014	Time Stored 1:37 PM
----------------------------------	--------------------------------	-------------------------------

Operator Information

Event ID 2238
Facility ID * 172870
Facility Name * BREITBURN OPERATING, LP
Operator Name * BREITBURN OPERATING, LP

Well Information

Well Name /ID * HOLE 86	API Well Number * 04-059-21247
Well Type * OIL	Well Geographical Coordinates (NAD 83 Format)
County * ORANGE	Well Latitude * 33.897998
Zip Code * 92835	Well Longitude * -117.898821

Notification Type

Notification Type * ORIGINAL
Previous Event ID for Cancellation, Revision Date or Other

Description of Well Activities

Select all that apply. If conducting a series of, or any combination of well production stimulation or treatment activities, identify all types of well production stimulation or treatment activity conducted.

Please click the Add button to the right to enter Well Activities		Add
Well Activity * WELL REWORK	<input checked="" type="checkbox"/> Hydraulic Fracturing	
	<input checked="" type="checkbox"/> Gravel Packing	
Start Date * 09/10/2014	<input checked="" type="checkbox"/> Maintenance Acidizing	
Type of Drilling 	<input checked="" type="checkbox"/> Matrix Acidizing	
	<input checked="" type="checkbox"/> Acid Fracturing	
	Other (Please List) 	

Nearest Sensitive Receptor Located within 1,500 feet of well

<input checked="" type="checkbox"/> Well Has Sensitive Receptor	Receptor Facility Name
---	-----------------------------------

Receptor Type

RESIDENCE

Receptor Distance to Well in feet

704

Address

1604 TYLER DR.

City

FULLERTON

Zip Code

92835

Certification Statement

Pursuant to SCAQMD Rule 1148.2(d), this form shall be submitted to the District no more than 10 days and no less than 24 hours prior to the start of well drilling, well completion, or well rework. If the start date(s) of subject activities is modified, the owner or operator shall notify the District at least 24 hours prior to the new start date if modified to occur earlier than the original start date, or within 24 hours prior to the original start date if modified to occur after the original start date, or if the original start date is cancelled. By clicking the checkbox below, I certify that I am the duly-authorized person to submit this form. I hereby attest, to the best of my knowledge, that the information contained herein is true, accurate and complete. With regard to information that I do not have personal knowledge of, I hereby attest that I have accurately entered the information contained herein from authorized personnel who represented that the information is true, accurate and complete.

☐ I Agree to the above Certification Statement *

Update on Implementation of Rule 1148.2

Rule 1148.2 Working Group Meeting
November 12, 2014

Background – Rule 1148.2

- Adopted April 5, 2013
- Applies to operators of oil and gas wells and chemical suppliers
- Requires pre-project notification, emissions and chemical usage reporting for drilling, well completion, or rework activities
- SCAQMD website where the public may access notification and chemical usage information

(Adopted April 5, 2013)

RULE 1148.2 NOTIFICATION AND REPORTING REQUIREMENTS FOR OIL AND GAS WELLS AND CHEMICAL SUPPLIERS

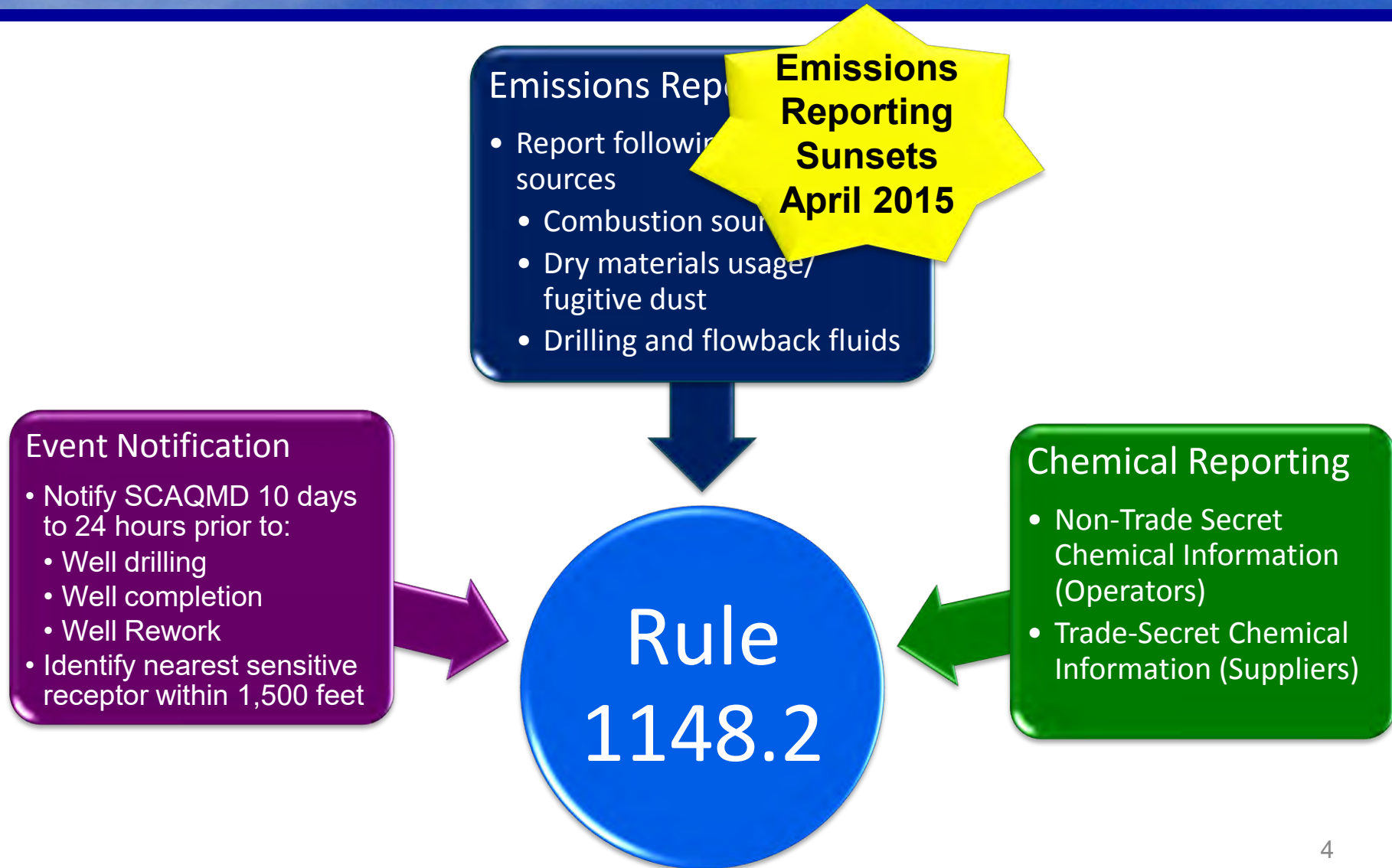
- (a) **Purpose**
The purpose of this rule is to gather air quality-related information on oil and gas well drilling, well completion, and well reworks.
- (b) **Applicability**
This rule applies to any operator of an onshore oil or gas well located in the District that is conducting oil or gas well drilling, well completion, or well reworks. In addition, this rule applies to suppliers as defined in paragraph (c)(14).
- (c) **Definitions**
For the purposes of this rule, the following definitions shall apply:
- (1) **ACIDIZING** means a treatment of the wellbore or reservoir formation with an acid to either clean out scale, damage, or other debris in the well, or react with the soluble substances in the formation to improve permeability and enhance production of oil and gas.
 - (2) **AIR TOXIC** means any substance identified on a list that is compiled and maintained by the California Air Resources Board pursuant to Health and Safety Code Section 44321.
 - (3) **CHEMICAL FAMILY** means a group of chemicals with related physical and chemical properties.
 - (4) **DRILLING** means digging or boring into the earth for the purpose of developing, extracting, or producing oil, gas, or other hydrocarbons, but does not include remediation efforts to clean-up or remove contamination.
 - (5) **DRILLING FLUID** means fluid used to lubricate the drill string, line the walls of a well, flush cuttings to the surface, and create enough hydrostatic weight to prevent blowouts.
 - (6) **FLOWBACK FLUID** means the fluid that flows from an oil or gas well following a well production stimulation or treatment activity, either in preparation for a subsequent phase of well production stimulation or treatment activity, or in preparation for a cleanup and returning the well to production. The flowback period begins when material introduced into the well during the well production stimulation or treatment activity

1148.2 - 1

Board Resolution 13-31

- Convene Working Group within 6 months after the first emissions report is received to discuss equipment and chemical data, and emissions monitoring/sampling results
- Report semi-annually to Stationary Source Committee (SSC) on notifications, emissions, and chemical use reporting
- Report to the SSC within 2 years of rule adoption, findings and recommendations for the need, if any, for emission controls or regulatory efforts for well drilling, well completion, and well reworks

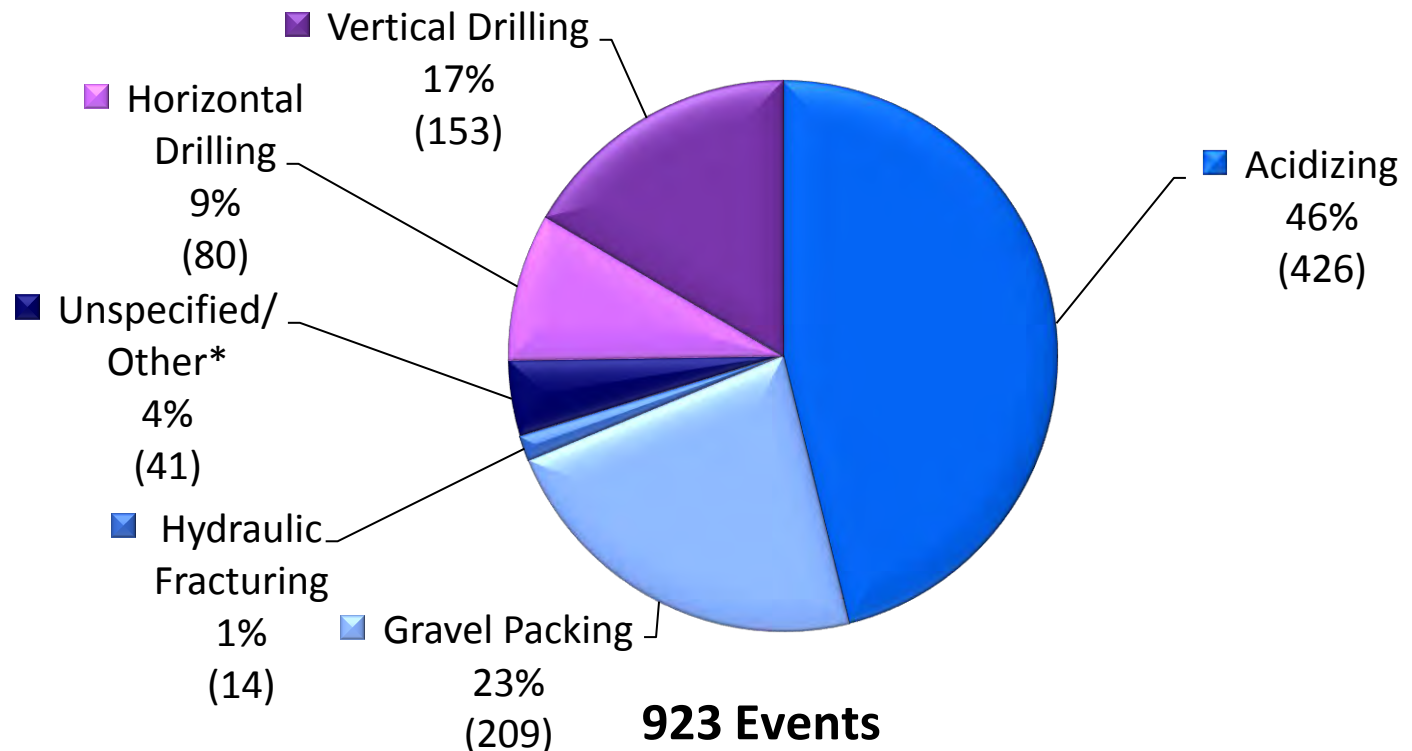
Key Elements of Rule 1148.2



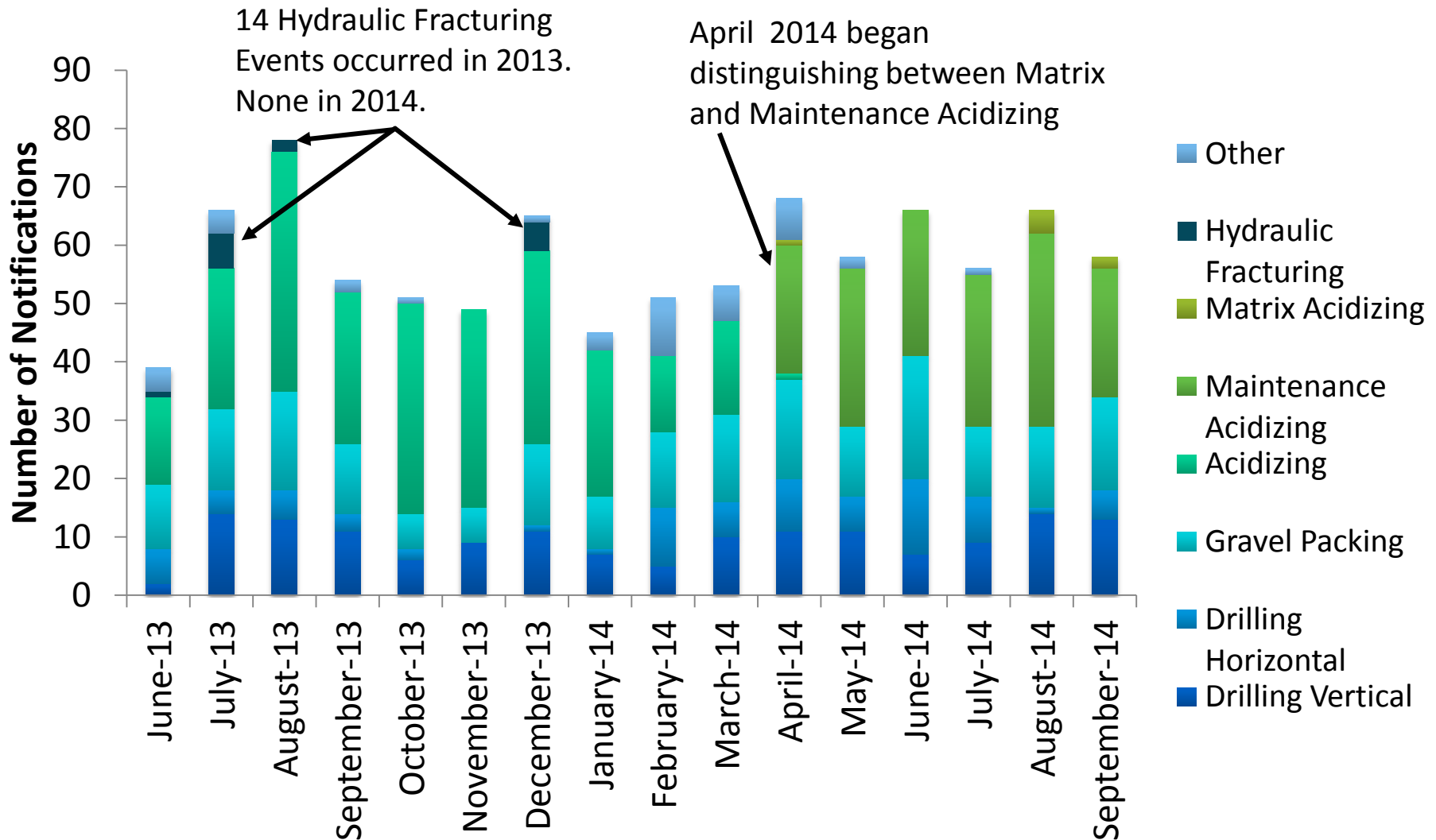
Summary of Event Notifications

Summary of Rule 1148.2 - Notification Data (June 2013 - Sep 2014)

- Approximately 821 Notifications representing 923 events (Some notifications have multiple events)
- >99% oil wells and <1% gas wells



Summary of Notifications

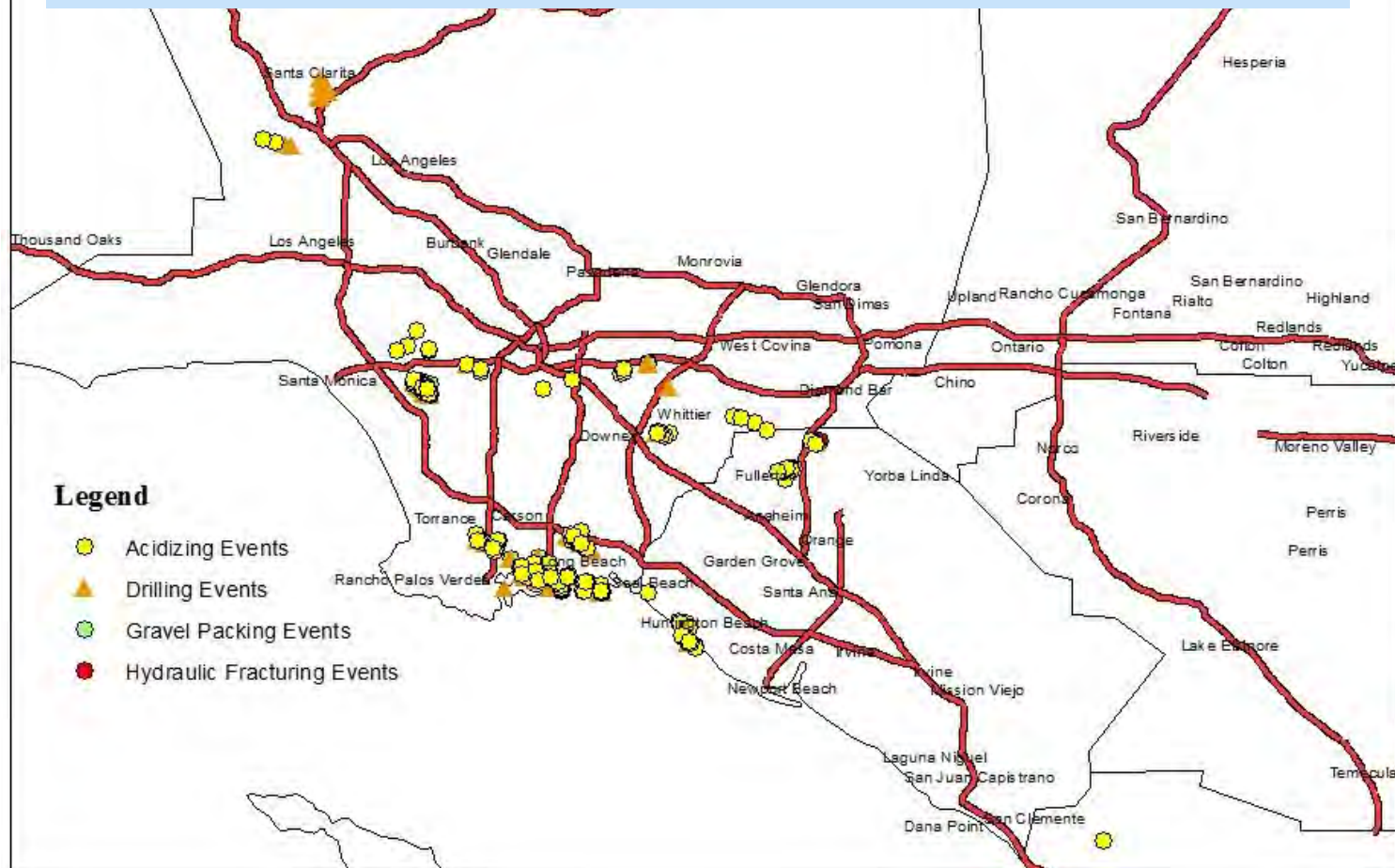


Acidizing Reporting Changes

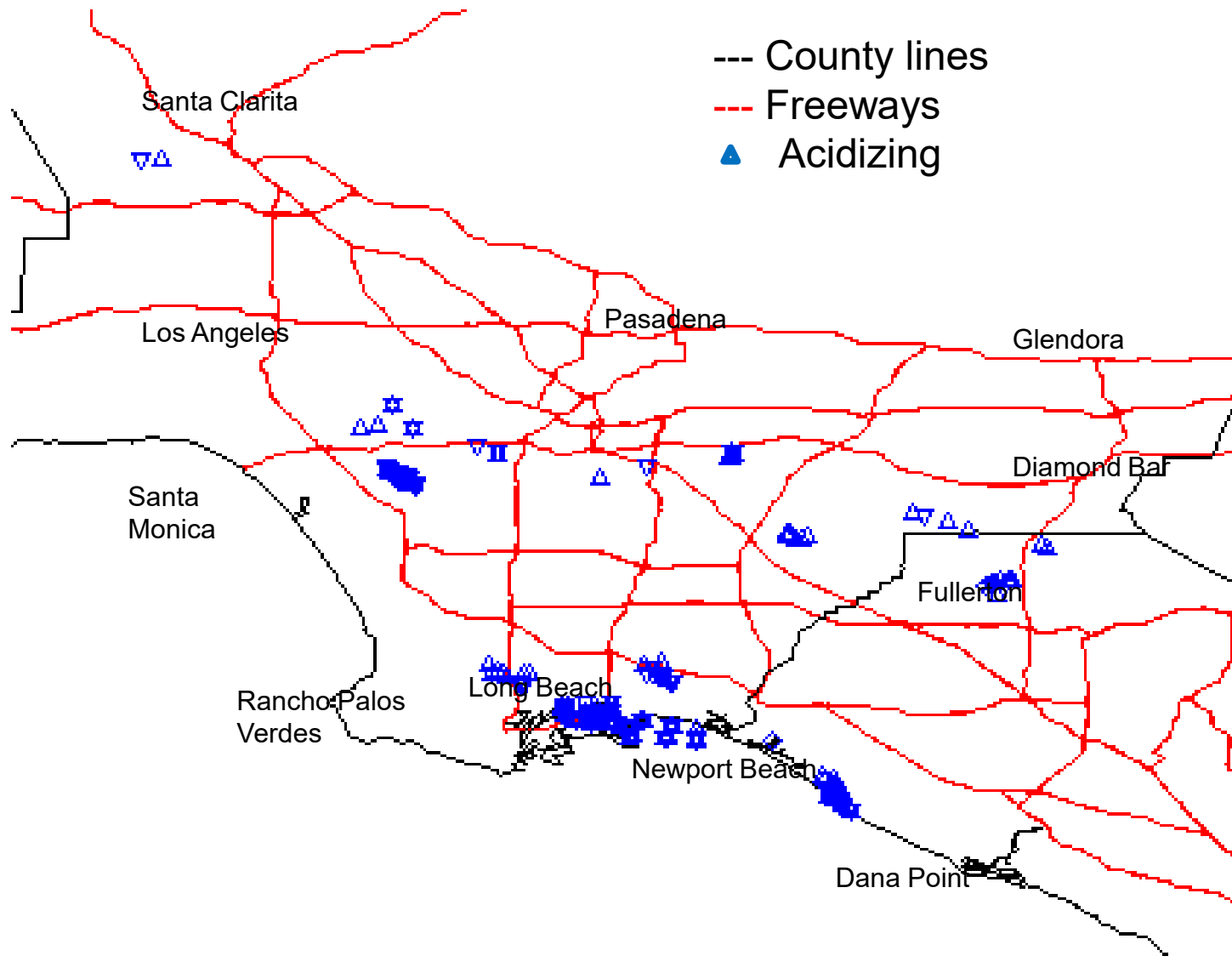
- Consultation with DOGGR led to conclusion that comparison of acidizing events between DOGGR and SCAQMD data bases resulted in inconsistencies due to:
 - DOGGR only logging Matrix Acidizing
 - SCAQMD logging all types of acidizing without break down of different types of acidizing
- SCAQMD reporting portal changed in April, 2014 to require operators to report different types of acidizing such as:
 - Maintenance Acidizing
 - Matrix Acidizing
 - Acid Fracking

R 1148.2 – Well Activity by Location

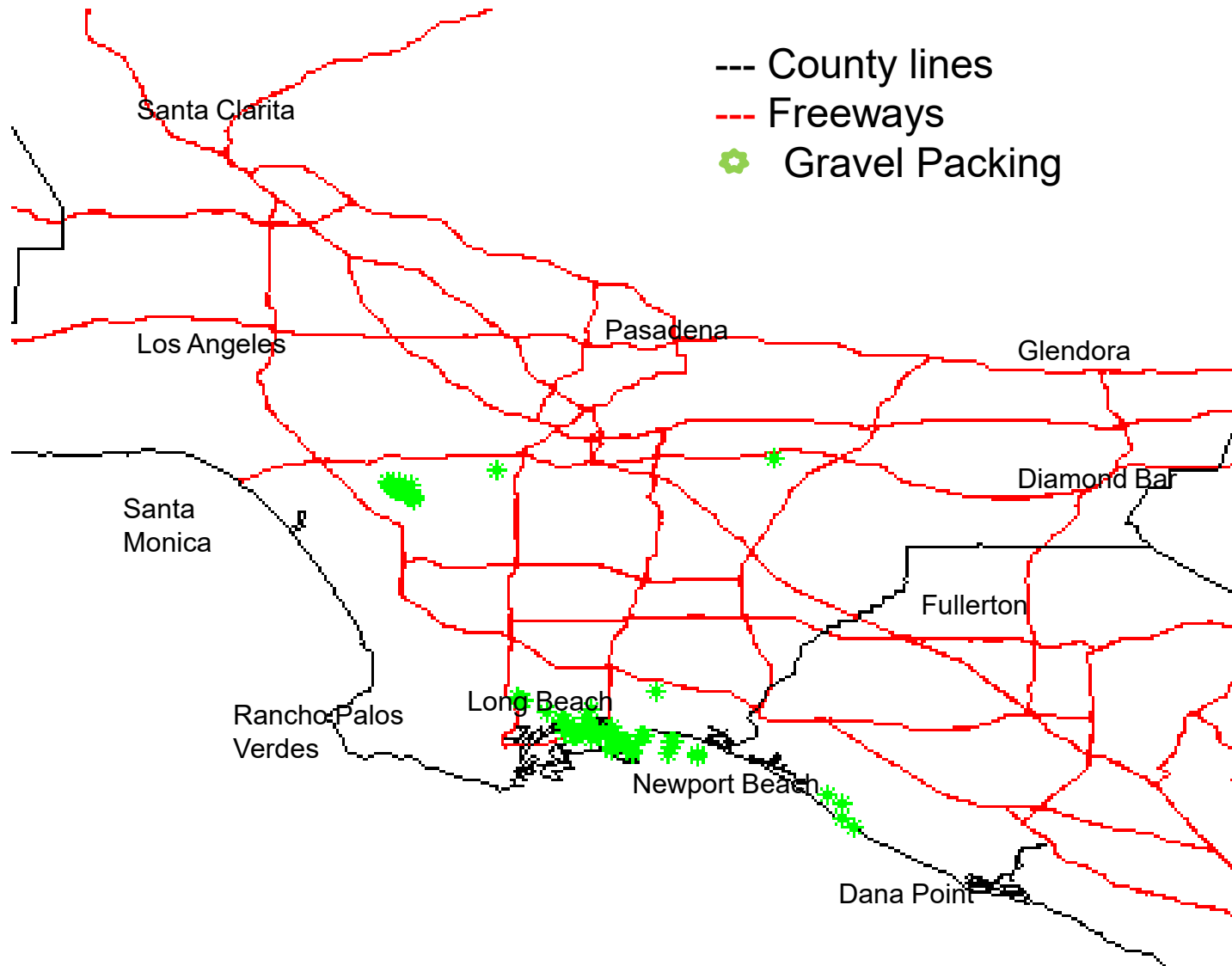
- 93% of notifications in Los Angeles County
- 7% of notifications in Orange County
- No notifications in Riverside or San Bernardino County



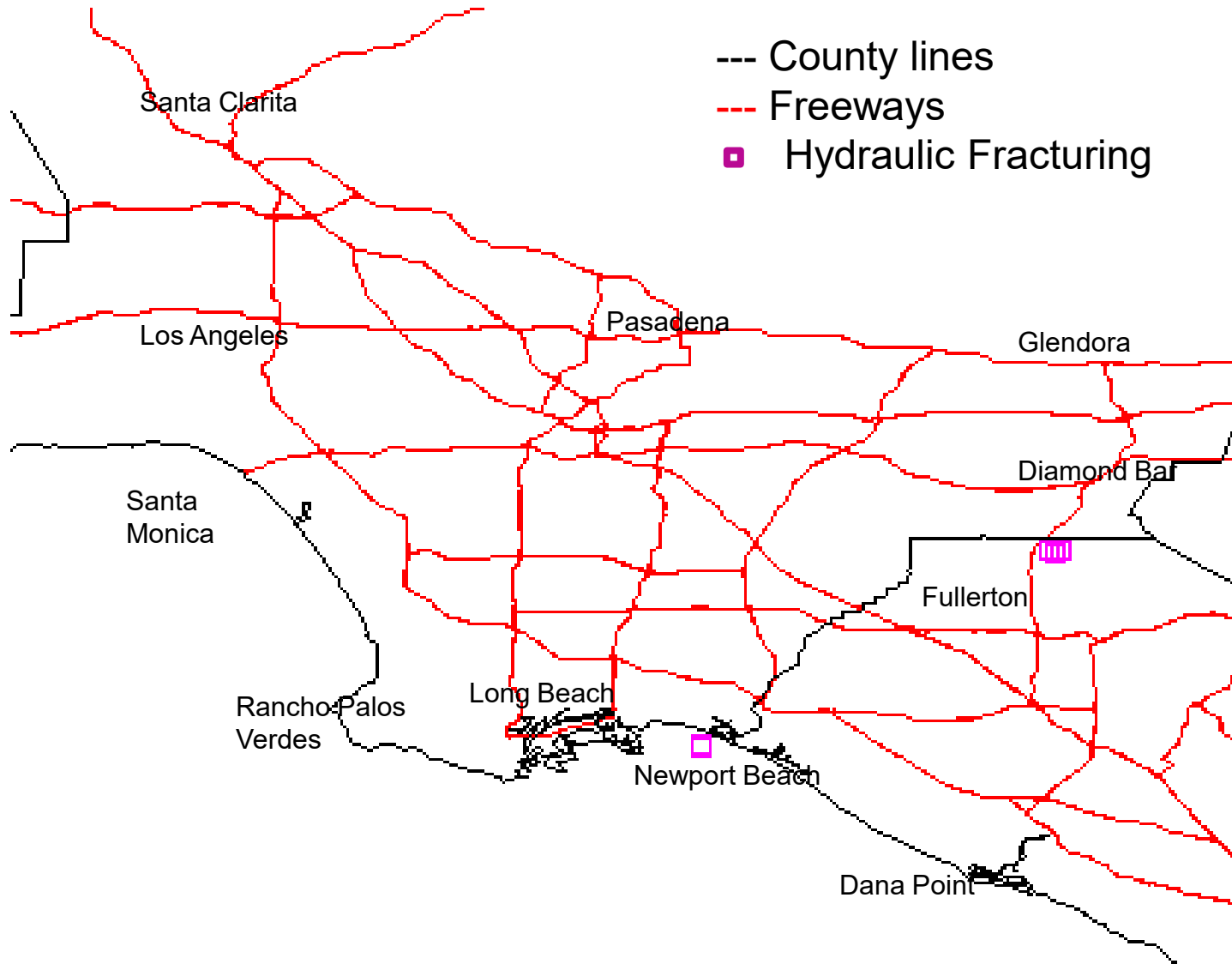
Location of Acidizing Events



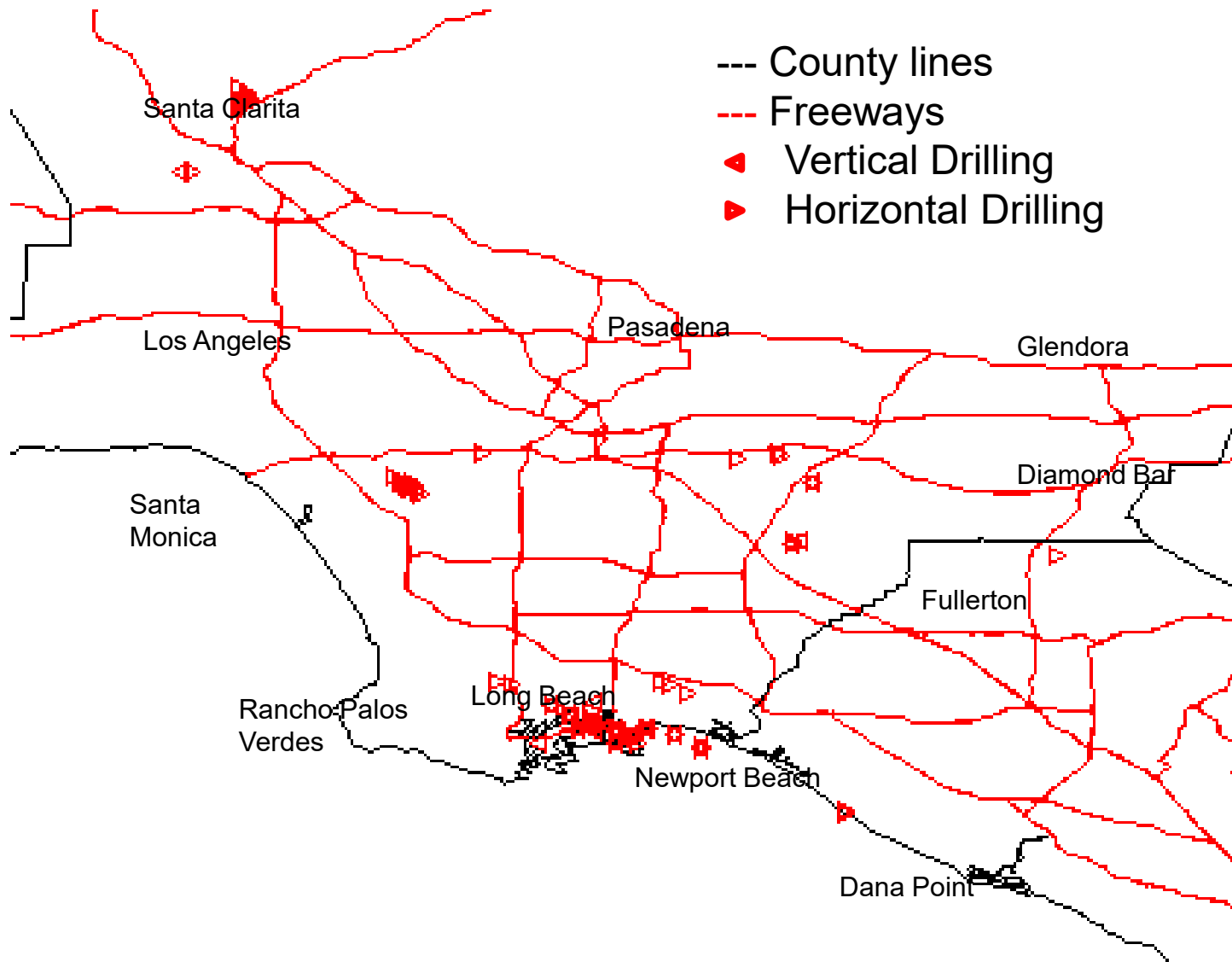
Location of Gravel Packing Events



Location of Hydraulic Fracturing Events

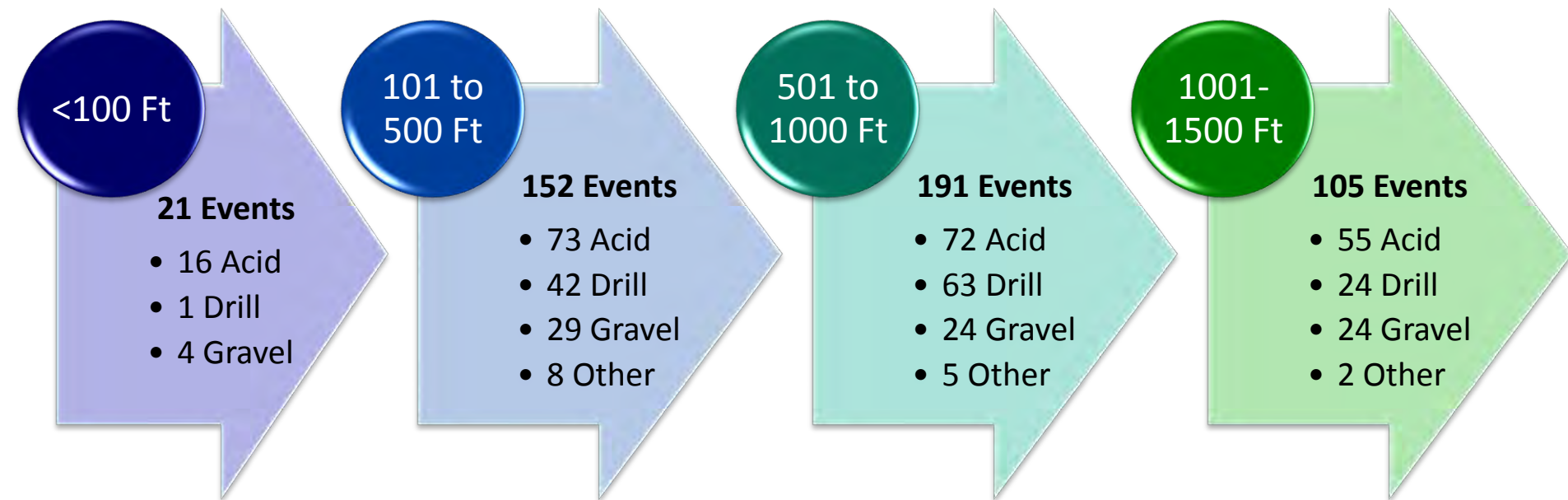


Location of Drilling Events

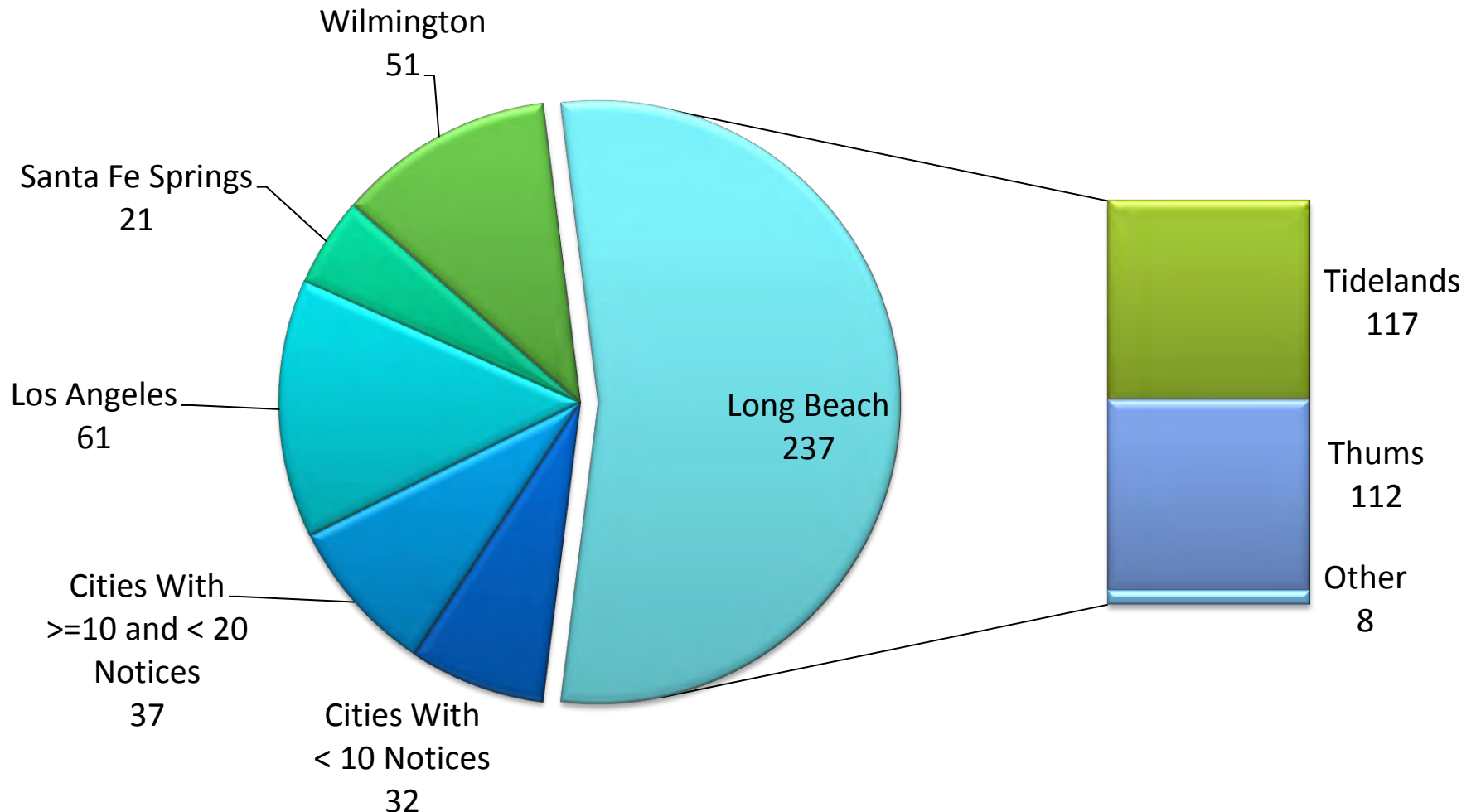


Distance to Sensitive Receptor

- ~ 50% of events $\leq 1,500$ feet from sensitive receptor
- All 14 hydraulic fracturing events $> 1,500$ from sensitive receptor



Distribution of Well Activities Near Sensitive Receptors by City



469 Notices for Well Events <1,500 Feet from a Sensitive Receptor

The background of the slide is a photograph of a bright blue sky filled with large, fluffy white cumulus clouds. The clouds are concentrated in the lower half of the image, while the upper half is a clearer, deeper blue.

Summary of Emissions Reporting

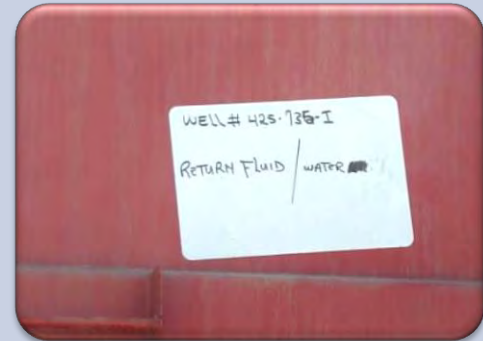
Emissions Reporting



Calculated
and
analyzed
combustion
emissions



Analyzed
reports for
amount of
dry
materials
used



Analyzed
reports for
flowback
fluids

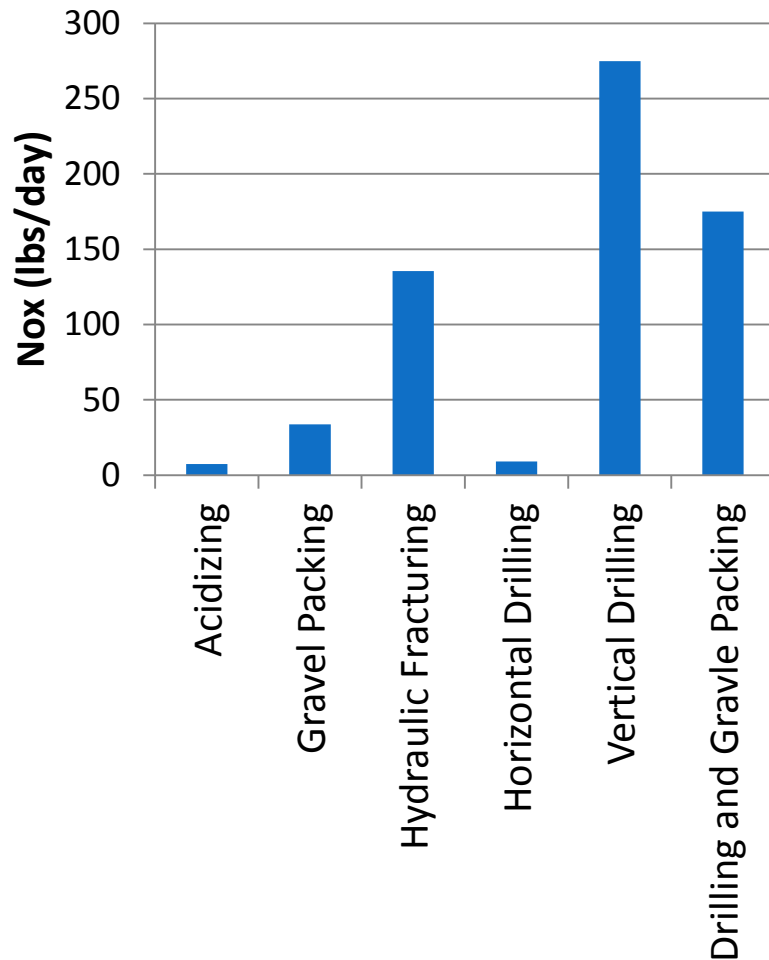
Emissions from Combustion Equipment

- Calculated average NO_x and PM emissions per event and per day
- Assumed a load factor of 0.6 (CARB recommended)
- Operators report engine horsepower, hours of operation, and engine Tier
- Used composite CARB emission factor if Tier was not reported

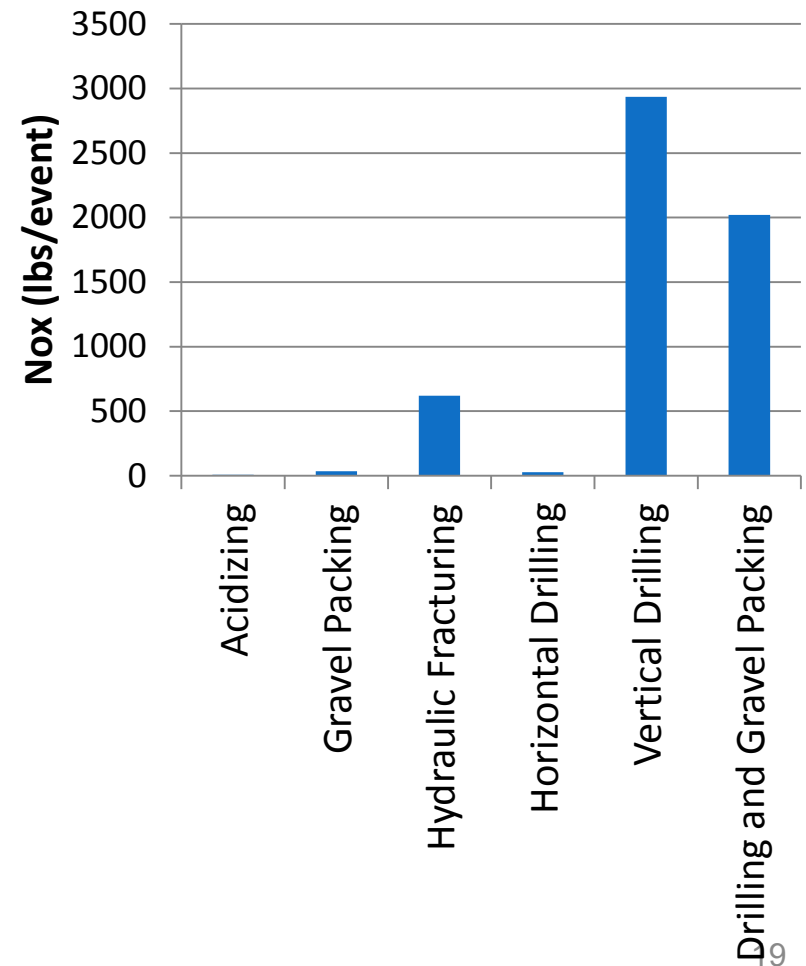


Average NOx Emissions

NOx Emissions Per Day

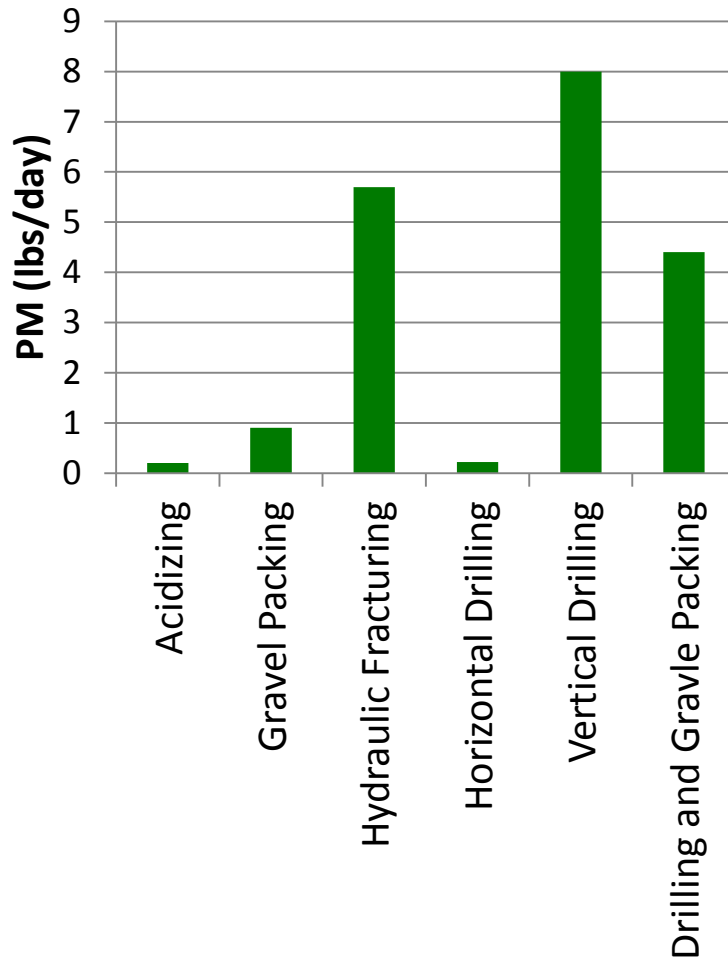


NOx Emissions Per Event

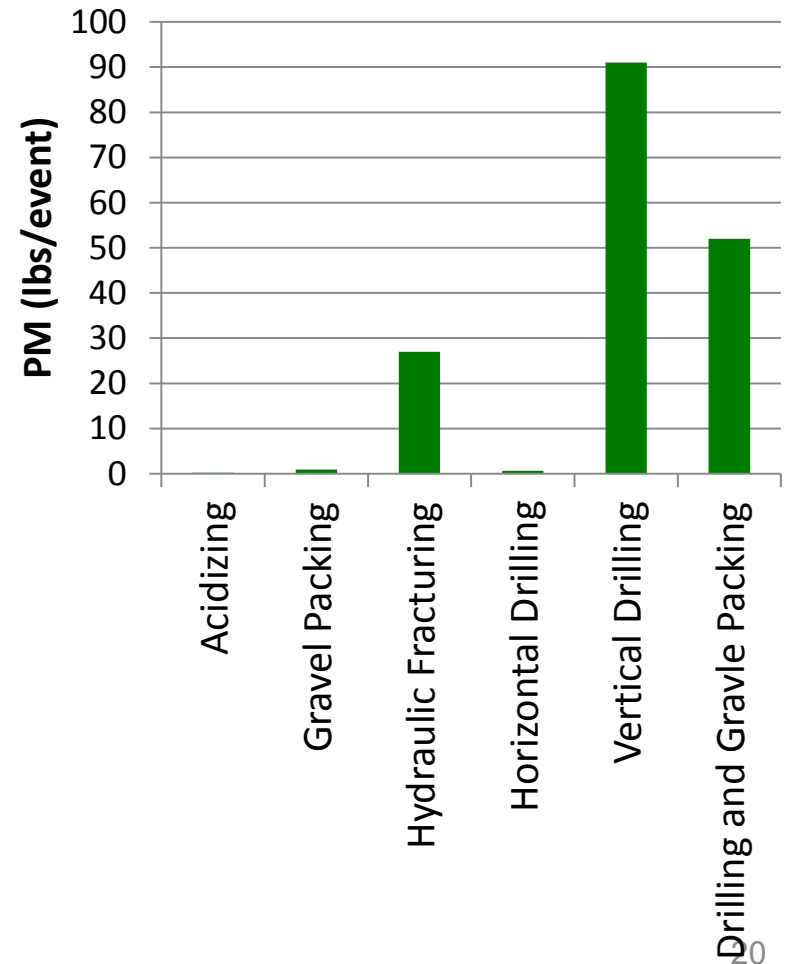


Average PM Emissions

PM Emissions Per Day



PM Emissions Per Event

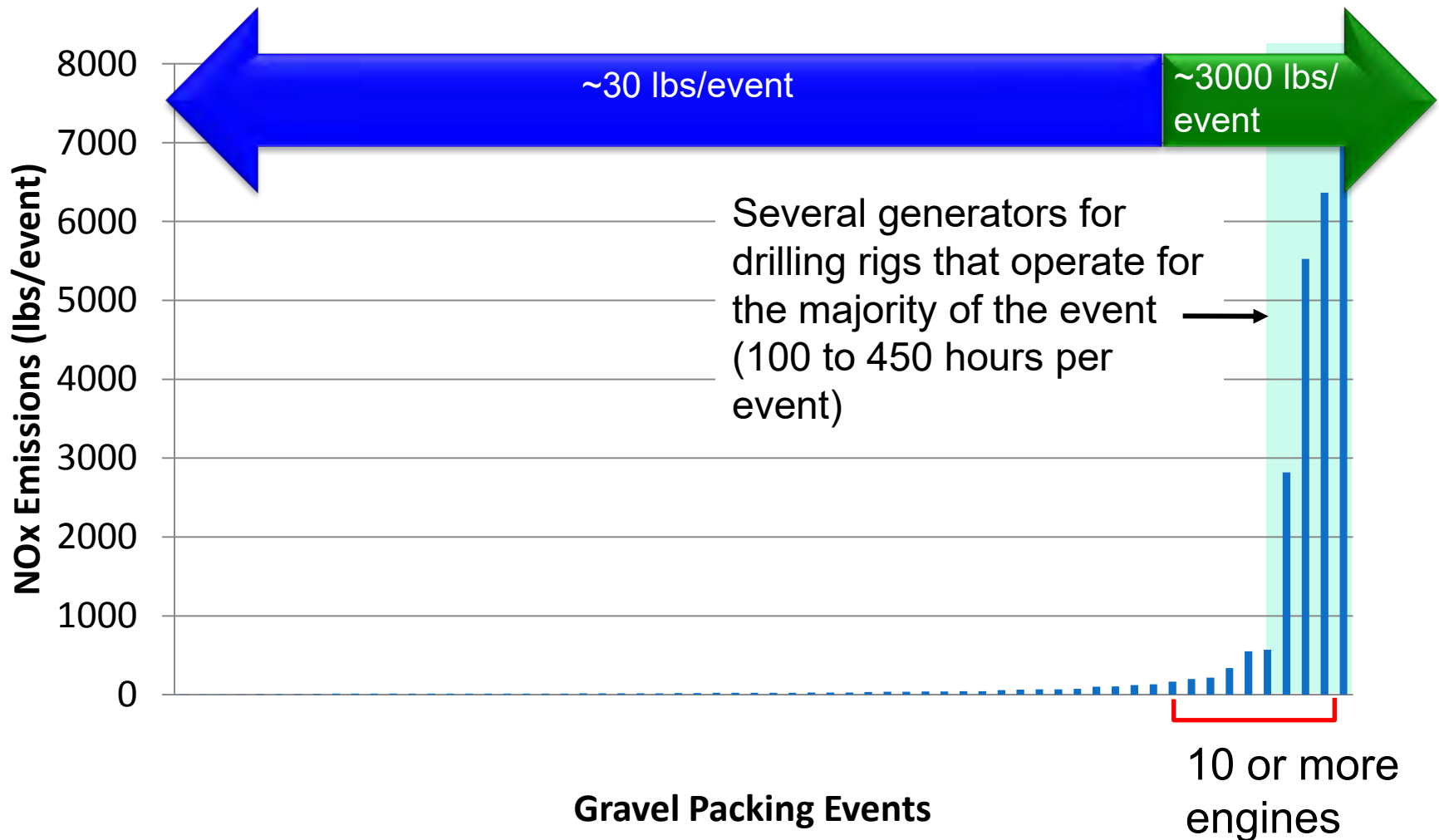


Combustion Equipment Summary

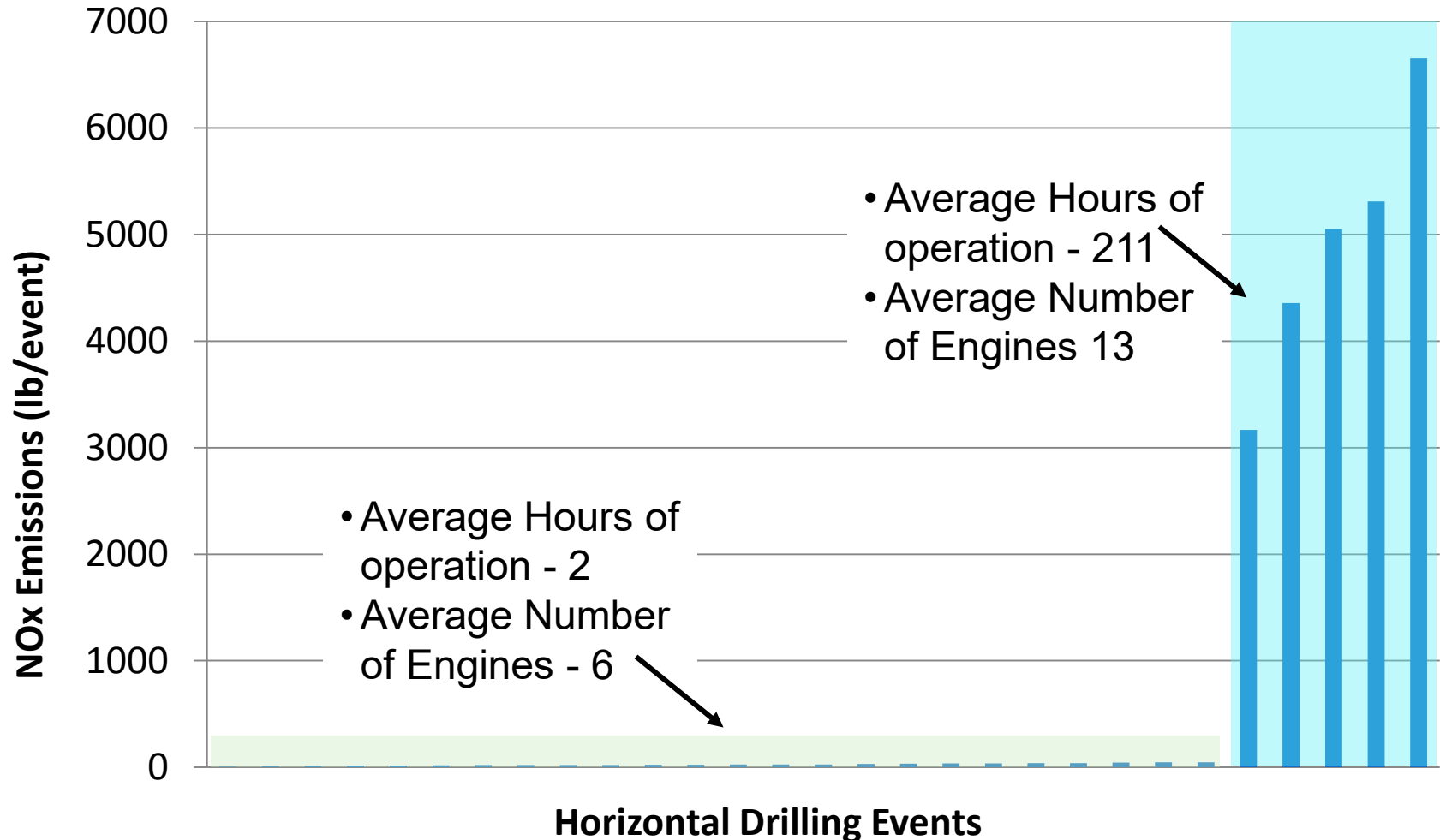
	Average Engine Size (HP)	Average Operating Hours/ Event	Average Maximum Operating Hours/ Event*	Average Event Duration	Average Number of Engines
Vertical Drilling	566 HP	102 Hours	198 Hours	19 Days	11
Gravel Packing	495 HP	10 Hours	31 Hours	4 Days	6
Horizontal Drilling	451 HP	38 Hours	310 Hours	10 Days	7
Acidizing	460 HP	4 Hours	12 Hours	1 Day	2
Hydraulic Fracturing	960 HP	13 Hours	32 Hours	6 Days	8

* Individual engine maximum

Gravel Packing Combustion Emissions



Horizontal Drilling Combustion Emissions



Assumptions for Estimating Cancer Risk from Single Drilling Operation

- Estimated lifetime cancer risk for single drilling event
 - Average PM emissions (90 lbs/event)
 - Maximum PM emissions (423 lbs/event)
- Assumed radius of 25 yards for engine distribution
- Long Beach meteorology conditions
- Used current and proposed revised risk assessment methodology
- Evaluated risk at varying receptor distances up to 1,500 feet

Estimated Cancer Risk from Single Drilling Event

Revised

DRAFT Cancer Risk (Current Risk Assessment Methodology) (in a million)

	Distance to Receptor 100 Feet	Distance to Receptor 500 Feet	Distance to Receptor 1,500 Feet
Cancer Risk (90 lbs/event)	0.07	0.04	0.02
Cancer Risk (423 lbs/event)	0.26	0.14	0.08

DRAFT Cancer Risk (Revised Risk Assessment Methodology)* (in a million)

	Distance to Receptor 100 Feet	Distance to Receptor 500 Feet	Distance to Receptor 1,500 Feet
Cancer Risk (90 lbs/event)	1.65	0.82	0.50
Cancer Risk (423 lbs/event)	7.12	3.83	2.33

* Assumed for children age 0 to 2 years.

Flowback Fluids Reporting

- Of the 626 emissions reports, only 9 events reported flowback fluid
 - 2 Vertical Drilling (larger volumes of few thousands gal)
 - 2 Well Redrill
 - 2 Maintenance Acidizing (small volume of ~28 gal reported)
 - 3 Unspecified well completions and well reworks
- No flowback fluids reported for gravel packing events
- Reports consistent with site visits

Dry Materials Reporting


- As of September 2014 – dry materials reported on 342 events
- On average reported per event:
 - 14 types of dry materials
 - ~140,000 lb of dry material
- Examples of dry materials:
 - Alpine spotting beads
 - Bicarbonate of soda
 - Cement
 - Drilling Mud
 - Gravel Pack Sand
 - Magma Fiber
 - Potassium Chloride
 - Walnut Shells
 - Sawdust



Emissions Reporting Findings

- Drilling operations have the highest NO_x and PM emissions
- Drilling operations generally have several engines that will operate for the duration of the event
- Drilling rigs at gravel packing events can operate over a long duration (100 to 450 hours)
- Cancer risk for the largest drilling events can pose a significant health risk at close in receptors



The background of the slide is a photograph of a bright blue sky filled with large, white, puffy cumulus clouds. The clouds are more concentrated in the lower half of the image, while the upper half is a clearer, deeper blue.

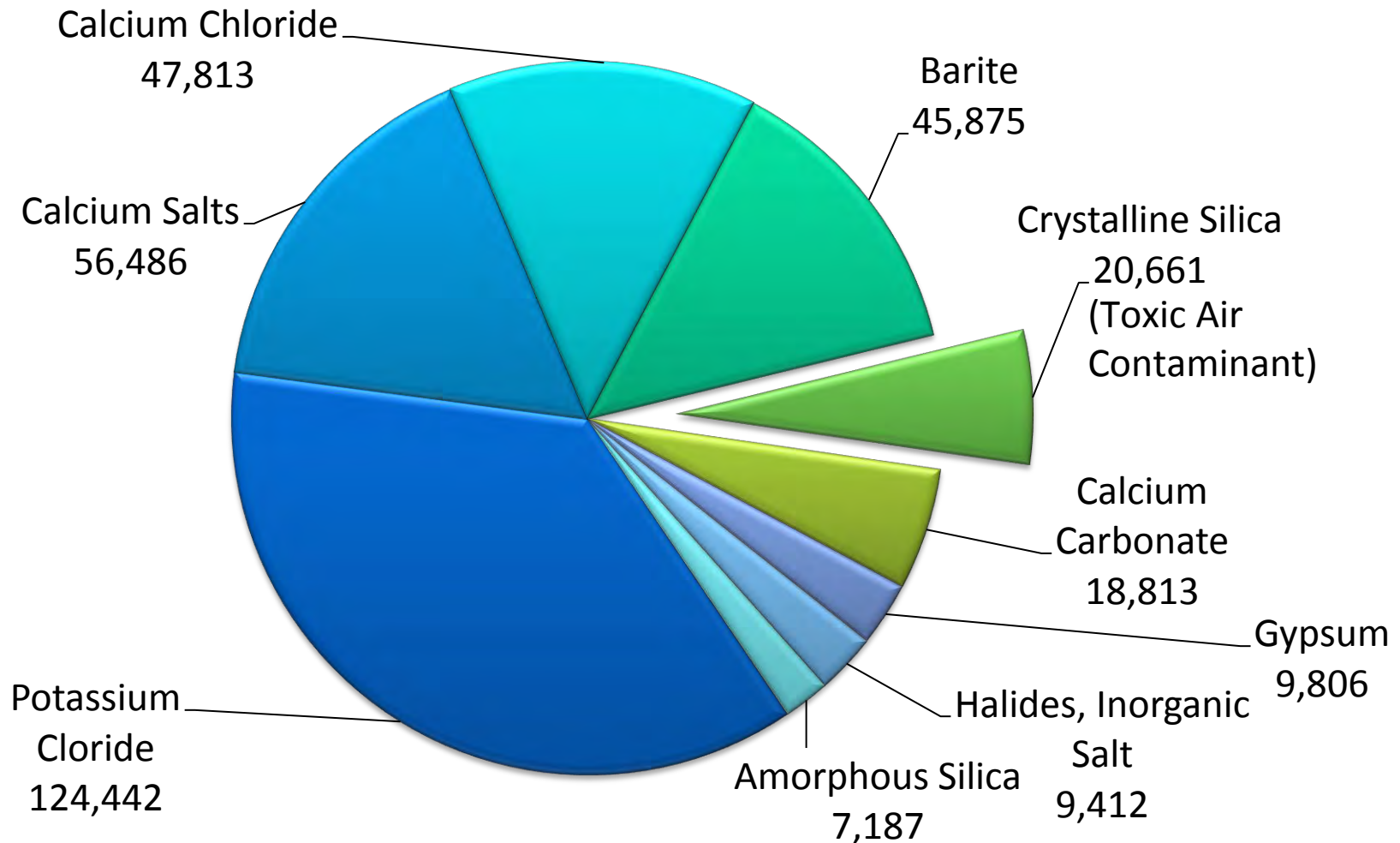
Summary of Non-Trade Secret Chemical Reporting

Non-Trade Secret Air Toxic Chemicals Used in Well Activities

Chemical Ingredient	Acidizing	Drilling	Gravel Packing	Hydraulic Fracturing
Crystalline Silica		✓	✓	✓
Ethylbenzene	✓			
Ethylene Glycol	✓	✓	✓	✓
Formaldehyde	✓	✓	✓	
Glutaral		✓	✓	
Hydrochloric Acid	✓			
Hydrofluoric Acid	✓			
Methanol	✓	✓	✓	✓
Naphthalene	✓	✓	✓	
Phosphoric Acid		✓		
Sodium Hydroxide			✓	✓
Toluene	✓			
Xylene	✓			

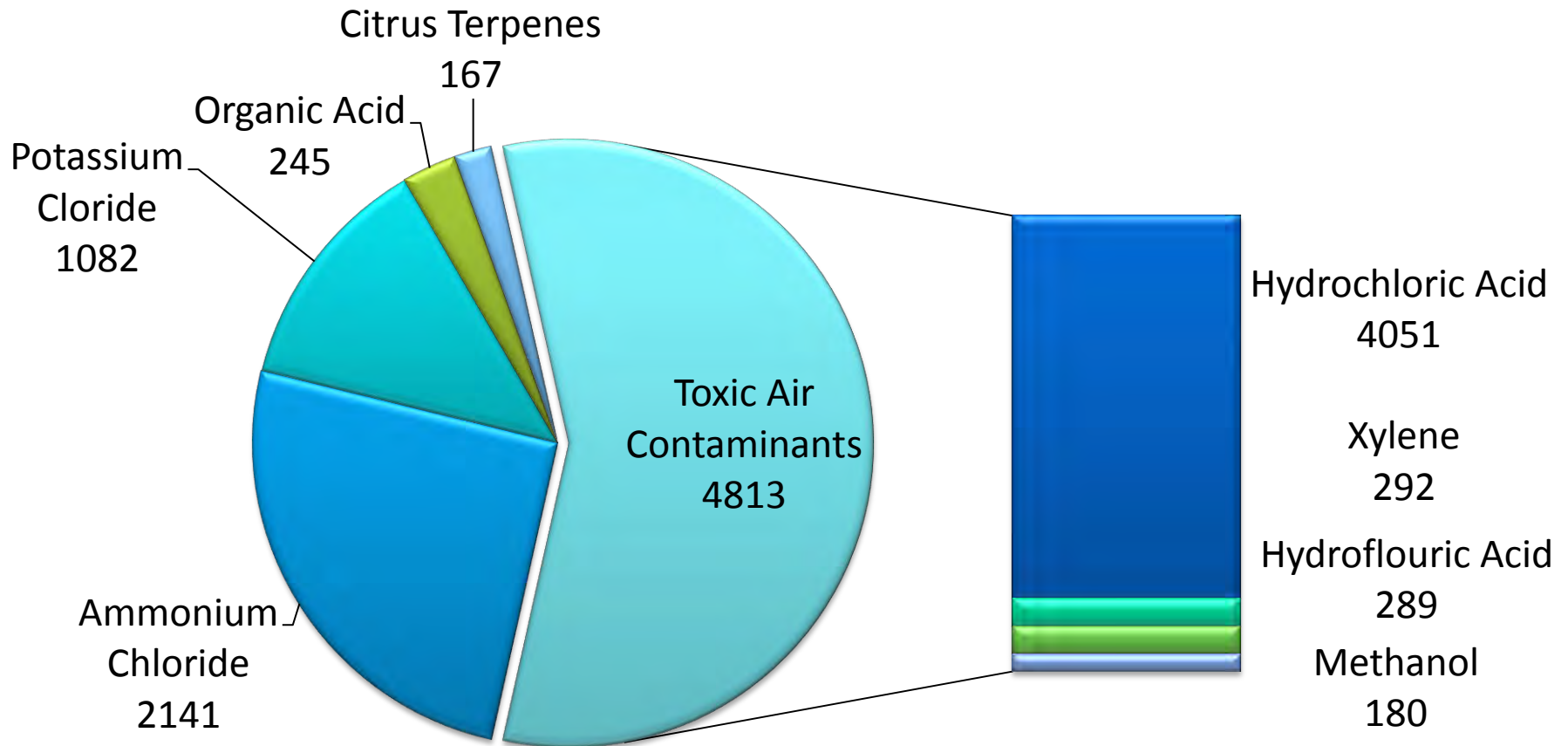
Drilling

(Top 9 Chemicals Used (lbs))



Average Non-Trade Secret Chemical Use
741,451 lbs of Water Used

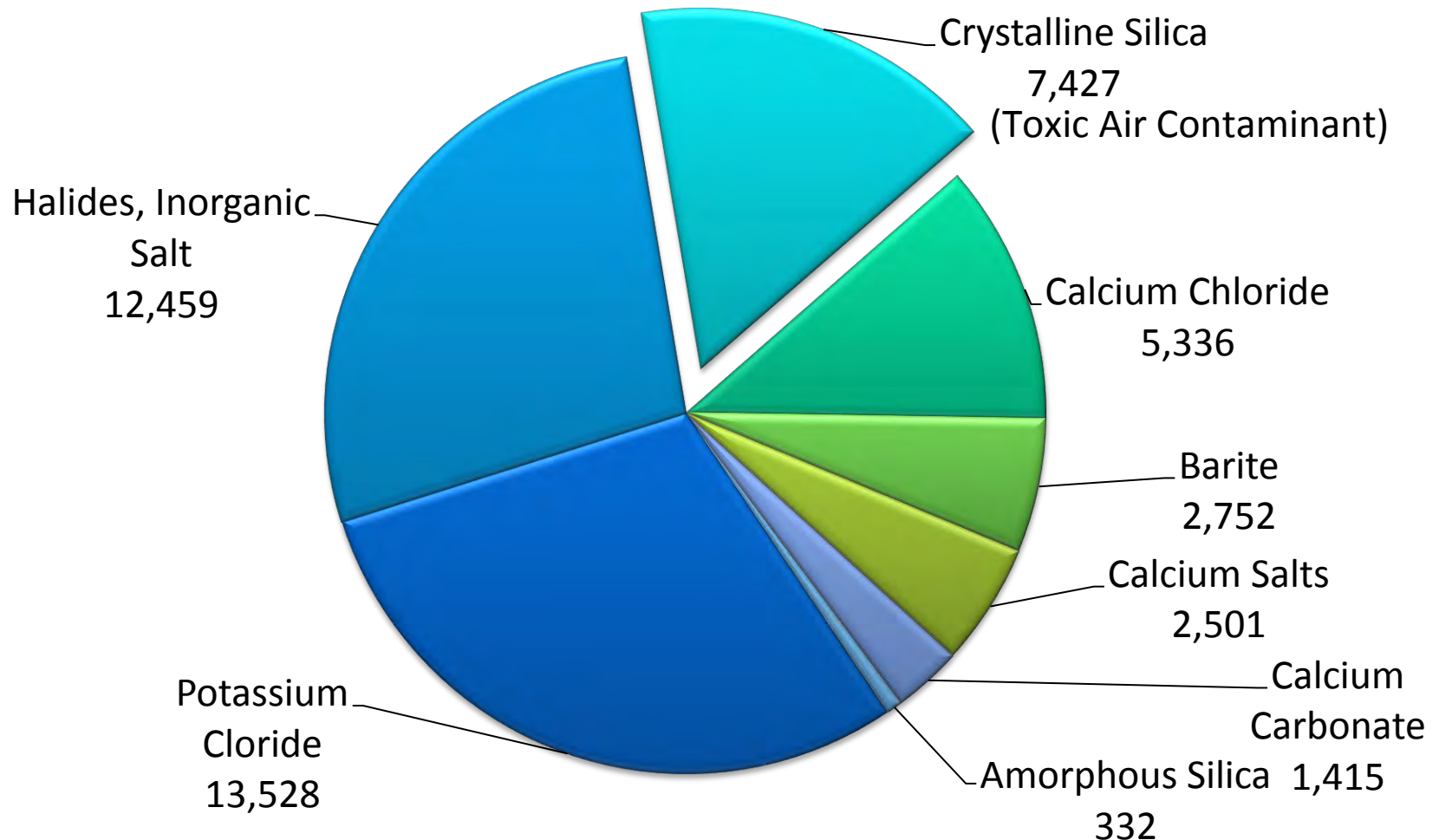
Acidizing (Top 8 Chemicals Used (lbs))



**Average Non-Trade Secret Chemical Use
109,389 lbs of Water Used**

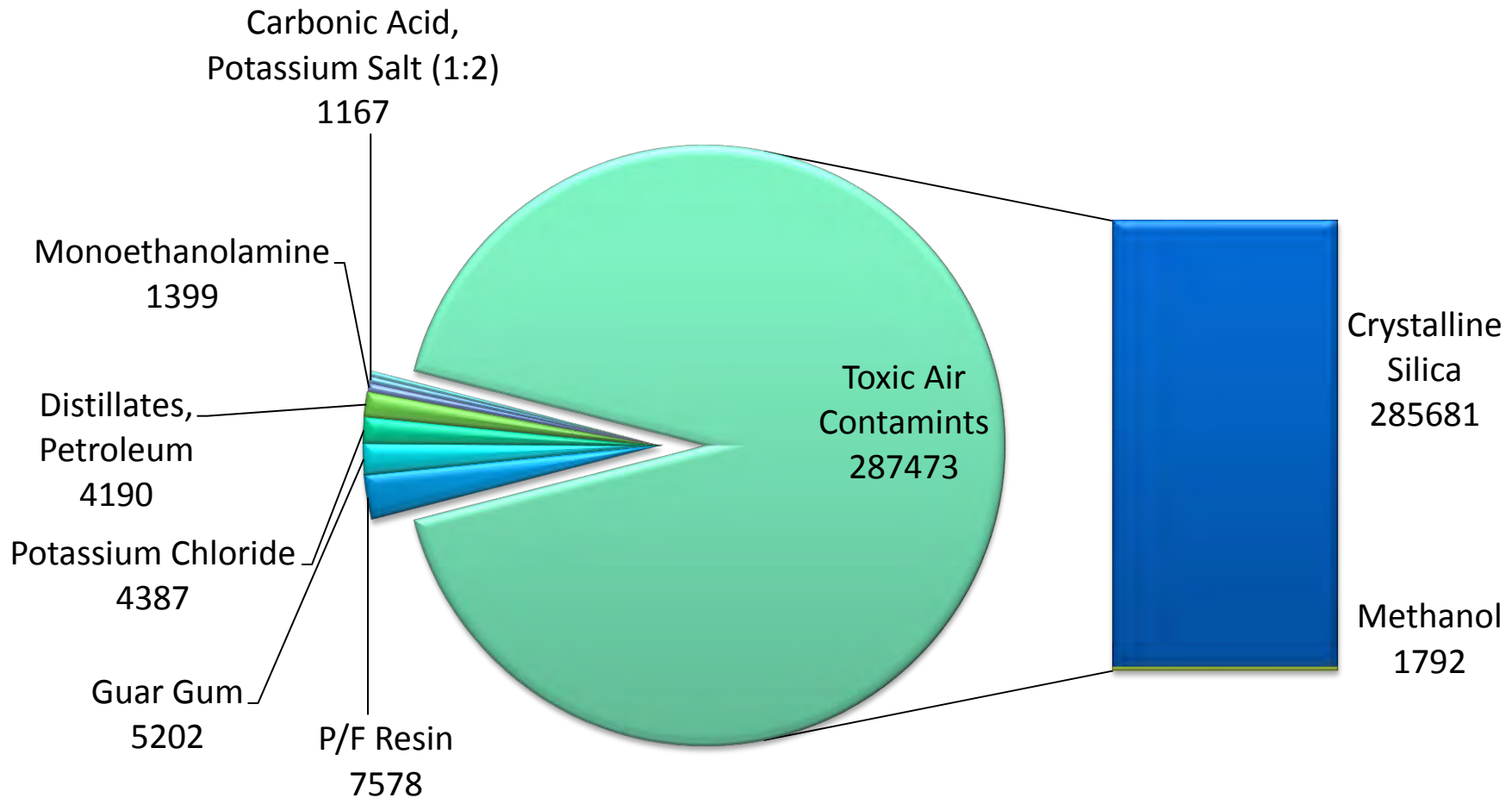
Gravel Packing

(Top 8 Chemicals Used (lbs))




Average Non-Trade Secret Chemical Use
62,582 lbs of Water Used

Hydraulic Fracturing (Top 11 Chemicals Used (lbs))



**Average Non-Trade Secret Chemical Use
Reported 2,044,054 lbs of Water Used**

The background of the slide is a photograph of a bright blue sky filled with large, white, puffy cumulus clouds. The clouds are concentrated in the lower half of the image, while the upper half is a clearer, deeper blue.

Summary of Observations, Monitoring, and Sampling

R1148.2 – Well Inspection Summary

- Since June 2013, SCAQMD staff conducted 104 inspections of oil/gas sites performing drilling, well completion, and well rework operations
 - 21 well drilling events
 - 14 hydraulic fracturing events
 - 44 acidizing events
 - 11 gravel packing events
 - 4 Misc. events



R 1148.2 – Well Inspection Summary

- Observations at well inspections include:
 - Visible smoke at 13 inspections (13%)
 - Visible dust at 13 inspections (13%)
 - Noticeable odors at 10 inspections (10%)



Sampling & Monitoring – Draft Standard Operating Procedure (SOP)

- Objective
 - Discern emissions generated from various well activities
 - Provide general guideline for SCAQMD personnel to follow when conducting monitoring/sampling
- Elements
 - Covers equipment for monitoring, sampling, and safety (PPE) to be used
 - Guidelines and procedures for gradient monitoring
 - Forms for field observation/project notes
 - Additional instruction for gravel packing and hydraulic fracturing events

Sampling and Monitoring Equipment

- Handheld devices used to measure PM and H₂S
 - Jerome Monitors (H₂S)
 - DustTrak Monitors (PM)



- Summa canisters used to measure hydrocarbons



- Sample vials and jars to test flowback fluids and drilling mud



Challenges

- Coordinating site visits is challenging due to rescheduling notifications
 - 48% of submitted notifications get rescheduled
 - 10% of submitted notifications get rescheduled multiple times

Sampling and Monitoring (July – October 2014)

- Well Activities Sampled/Monitored
 - Re-drill (1)
 - Maintenance acidizing (1)
 - Matrix acidizing (1)
 - Gravel packing (3)
- Measurements taken:
 - Monitored H₂S and PM
 - Canister samples for non-methane organic compounds (NMOC) upwind, downwind, and at return fluid catch basin and storage tanks
 - Return fluids collected in sample vials

Monitoring and Sampling Results (July – October 2014)

Event	Event ID	Date	Handheld Results for PM and H ₂ S	Canister Results for Organics	Other Observations
Maintenance Acidizing	1934	7/15/14	<ul style="list-style-type: none"> • No elevated levels of PM10. • No elevated levels of H₂S. 	No canister samples taken.	Diesel odors from engines used in well activities. Complaint reported to SCAQMD from the public.
Matrix Acidizing	2238	9/10/14	<ul style="list-style-type: none"> • No elevated levels of PM10. • No elevated levels of H₂S. 	No elevated levels (typical ambient air range of 100-700 ppbc) of NMOCs.	Petroleum hydrocarbon odors 75 feet from subject well.
Gravel Packing	2329	9/25/14	<ul style="list-style-type: none"> • Slightly elevated levels of PM10 due to high wind speeds and dust from loose dirt roads. • No elevated levels of H₂S. 	No elevated levels (typical ambient air range) of NMOCs.	Strong petroleum hydrocarbon odors at catch basin for return fluid (open to atmosphere).
Gravel Packing	2329	9/26/14	<ul style="list-style-type: none"> • No elevated levels of PM10. • No elevated levels of H₂S. 	Elevated levels (900-2900 ppbc) of NMOC at catch basin.	Strong petroleum hydrocarbon odors at catch basin for return fluid (open to atmosphere).
Gravel Packing	2354	10/2/14	<ul style="list-style-type: none"> • No elevated levels of PM10, except for one short-term period of elevated levels due to road dust from vehicular traffic. • No elevated levels of H₂S. 	Elevated levels (20 – 13,000 ppmvc) of NMOCs at open hatch of Adler tank for return fluids. Above thresholds for SCAQMD Rules 1148.1, 1166, 1173, 1176, and 1178.	Strong hydrocarbon odors from Adler tank for return fluids.
Drilling	2356	10/17/14	Pending	Pending	Pending

Sampling & Monitoring Return Fluids from Catch Basin

- Interim holding area prior to storage in Adler tank
- Sampled within 2 feet of return fluid surface
- Results showed
 - Elevated levels of benzene, toluene, ethylbenzene, and xylene
 - Max NMOC concentration of 3,000 ppbc



Sampling & Monitoring Return Fluids from Adler Tank

- Return fluid goes directly to tank from well
- Sampled 2 feet of open hatch
- Results
 - Elevated levels of benzene, toluene, ethylbenzene, and xylene
 - High NMOC concentration of 13,000 ppm
- Max thresholds in SCAQMD Rules
 - 500 ppm (R1148.1)
 - 500 ppm (R1176)
 - 500 ppm (R1178)
 - 1,000 ppm (R1166)
 - 50,000 ppm (R1173)



Well Activity Observations – Flowback Fluids

- Gravel packing does not have flowback immediately after well treatments/stimulations due to low pressure in the formations found in the Basin
- “Return fluid” from well stimulation/treatment activities not viewed as “flowback” by operators
 - Rule 1148.2 defines this return fluid as “flowback”
 - SCAQMD staff monitoring and sampling return fluid
- Different techniques seen to capture/contain return fluids
 - Interim catch basin before storage in Adler tank with control
 - No catch basin, directly into Adler tank with no control

Well Activity Observations – Gravel/Sand Mixing

- Operators use different techniques to mix gravel/sand in well completion fluids:
 - Fabric tote over hopper (open system)
 - Plastic tote feed into hopper (closed system)



Controls and Housekeeping (Gravel Packing)

- Carbon canister drums connected to Adler tanks storing return fluid
- Keeping hatches closed at all times



- Plastic sheet ground cover to capture liquid leaks and spills of gravel packing fluids and dry materials

Findings from Sampling and Monitoring and Well Observations

- No elevated levels seen for H₂S or PM for acidizing or gravel packing
- Elevated NMOC concentration levels seen at holding areas of storage tanks for “return fluids” from gravel packing events
- Use of carbon canisters for Adler tanks and keeping hatches closed will reduce NMOC emissions
- Plastic tote for adding dry materials provides reduces opportunity for spillage

Summary of Compliance Activities

Key Requirements for Operators and Chemical Suppliers

Operators

- Submit Emissions Reports within 60 days
- Submit Non-Trade Secret Chemical Report within 60 days
- Must provide specific non-trade secret chemical information

Primary Chemical Suppliers

- Submit Trade-Secret Chemical Report within 60 days
- Identified by Operator
- Must provide specific chemical information

Secondary Chemical Suppliers

- Submit Trade Secret Chemical Report within 60 days
- Identified by Primary Supplier
- Must provide specific chemical information

Overall Compliance Approach

- Compliance Advisories
 - Issued compliance advisories if system-wide problem or
 - Issued compliance advisories if clarification regarding system-wide problem in reporting
- Notices to Comply
 - Issued Notices to Comply if operators or suppliers not submit required information and/or entire report
 - SCAQMD staff working with operators and suppliers to encourage compliance
- Notices of Violation
 - Failure to submit required forms after issuance of Notice to Comply
 - No Notices of Violation have been issued

Compliance Advisories

- Two compliance advisories sent to operators
- February 2014 Compliance Advisory
 - Operators advised to re-submit all reports where on-road engines were used to power well rework/ stimulation equipment pursuant to R1148.2 (e)(1)(C)
 - Operators incorrectly interpreting rule requirement that on-road engines usage need not be reported
- August 2014 Compliance Advisory
 - Operators advised to report fluid of injected and/or recovered fluids required by 1148.2 (e)(1)(E)(i)
 - High number of missing or zero entries for fluid volumes

Compliance Activities for Operators

Emission Reports

For each
Notification,
Verified
Emission
Report
Submitted
within 60 Days



Identified
Operators that
Did Not Submit
Emissions
Source Report



14 Notices to
Comply issued
to Operators
(47 Well Events)
for Failure to
Submit
Emissions
Source Report



- 19 out of 47 well events outstanding.
- Staff continuing to work with operators.

Compliance Activities for Operators

Non-Trade Secret Chemical Reports

For each
Notification,
Verified Non-
Trade Secret
Chemical
Report
Submitted
within 60 Days



Identified
Operators that
Did Not Submit
Chemical
Report



14 Notices to
Comply issued
to Operators
(143 Well
Events)
for Failure to
Submit
Chemical Report



- 17 out of 143 well events are outstanding.
- Staff is continuing to work with operators.

Data Analysis Approach for Chemical Supplier Reporting

- Examine quality of data reported by trade secret chemical Suppliers
- Identified issues with reporting by Suppliers:
 - Omitting CAS numbers
 - Providing chemical family names instead of the exact names of compounds
 - Omitting identification of compounds as toxics
 - Unsatisfactory entries of chemical ingredient names such as “non-hazardous ingredient” or “proprietary blend”
- Work with Suppliers on individual basis to correct these reporting issues

Compliance Activities for Primary Chemical Suppliers

Revised

Primary Supplier Must Submit Trade Secret Chemical Report within 60 Days



Identified Notifications Where Primary Suppliers Were Identified, but No Trade Secret Report Received



5 primary suppliers representing 63 well events issued NCs for failure to submit Chemical Report Forms.



- Working with suppliers through conference calls and emails
- Suppliers are submitting Chemical Report Forms
- Staff is continuing to work with suppliers and evaluating submittals

Primary Chemical Suppliers

Incorrect Reporting

- Evaluation of submitted Chemical Supplier Report Forms identified two primary suppliers submitting incorrect information such as:
 - Generic (substitute) information in lieu of detailed chemical ingredients
 - Missing CAS #
 - Not properly identifying chemical as an air toxic
- Suppliers notified through emails and conference calls and AQMD staff providing assistance on completeness of reports
- Current Status:
 - Primary suppliers have re-submitted all Chemical Supplier Report Forms
 - Staff currently evaluating completeness of reports

Compliance Activities for Secondary Chemical Suppliers

Revised

Secondary Supplier Must Submit Trade Secret Chemical Report within 60 Days



Identified Notifications Where Secondary Suppliers Were Identified, but No Trade Secret Report Received



11 secondary suppliers representing 243 well events issued NCs for failure to submit Chemical Report Forms



- Working with suppliers through emails and phone conferences
- Suppliers are submitting missing Chemical Reports
- Smaller suppliers contracted larger chemical suppliers to submit forms
- Staff is evaluating compliance for these submittals

Compliance Summary

- Progress in receiving reports and corrected reports
- There are still outstanding reports
- Staff will continue working with operators and suppliers to encourage compliance
- Compliance is ongoing

Next Steps

- Briefing Stationary Source Committee
November 21, 2014
- Continue to collect and analyze data
- Report back to the Working Group in
six months

TAB X

Freeport-McMoRan Oil & Gas
Land Department
5640 S Fairfax Ave.
Los Angeles, CA 90056

Telephone: 323.298.2211

July 5, 2013

City of Los Angeles
Department of Planning
Office of Zoning Administration
200 N. Spring Street, 7th Floor
Los Angeles, CA 90012

RE: Application for Determination of Methods and Conditions for Drilling
Jefferson Controlled Drill Site
Case No. ZA-17528

Dear Associate Zoning Administrator:

Freeport-McMoRan Oil & Gas LLC respectfully requests approval to use the above referenced controlled drill site to drill and re-drill three (3) wells as more particularly describe in the materials submitted herewith. Attached hereto are Additional Comments that Application believes will be of assistance to you in rendering your decision.

Applicant wishes to draw your attention to the last Associate Zoning Administrator's Finding of Fact, that ***"the current conditions of operations at this location are effective in reasonably mitigating any possible impact of the use of the site for drilling operations."*** (ZA Case No. ZA-17528(PA3), dated April 22, 2008, Finding of Fact No. 3, emphasis added.) (See Exhibit 7.) Because of this Finding, a public hearing was waived in 2008.

Accordingly, as was done in 2008, Applicant respectfully requests that the public hearing in this matter be waived. If a public hearing is set, Applicant's representative requests that the matter not be set for hearing on the following dates: August 14, 2013 through August 25, 2013.

Sincerely,


L. Rae Connet
Contract Land Advisor
(323) 298-2211 (office)
(310) 486-4955 (mobile)

ZA 17528

APPLICATION FOR DETERMINATION
OF METHODS AND CONDITIONS
2013
JEFFERSON CONTROLLED DRILL SITE

Additional Applicant Comments

Freeport-McMoRan Oil & Gas LLC respectfully requests approval to use the above referenced controlled drill site, located in Oil Drilling District U-124, to drill and re-drill three (3) wells as follows: drill one (1) new Class "B" well (water injection well) to bottom in Oil Drilling District U-124; re-drill one (1) Class "A" well (oil production well) and one (1) Class "B" well (water injection well), both to bottom in Oil Drilling District U-135.

Applicant wishes to draw your attention to the Zoning Administration's Finding of Fact, that ***"the current conditions of operations at this location are effective in reasonably mitigating any possible impact of the use of the site for drilling operations."*** (ZA Case No. ZA-17528(PA3), dated April 22, 2008, Finding of Fact No. 3, emphasis added.) (See Exhibit 7.) Because of this Finding, a public hearing was waived in 2008.

Request for Waiver of Public Hearing. As was done in 2008, Applicant respectfully requests that the public hearing in this matter be waived.

The Jefferson Drill Site is located at 1349-1375 Jefferson Boulevard, Los Angeles, California, more particularly described as follows:

Lots 1, 2, 3, 4, 7, 8, 9, 10, 21, 22, 23 and 24 of Block G of the Poole and James Tract, in the City of Los Angeles, County of Los Angeles, State of California, as per map recorded in Book 10, Page 194 of Maps, in the office of the County Recorder of said County.

Enclosed as Exhibit 1 is a plot plan depicting the existing facilities at the controlled drill site. The subject project is a 1.86-acre, rectangular, level parcel of land comprised of 12 record lots located on the north side of Jefferson Boulevard between Van Buren Place and Budlong Avenue. The drill site is classified in the C2-1VL-O, R2-1-O and RD1.5-1-O Zones and is developed as an Urbanized Controlled Drill Site identified as the "Jefferson Drill Site" as part of the Las Cienegas Oil Field. The drill site is located in Urbanized Oil Drilling District U-124 as established by Ordinance No. 129,760. The location is in Council District 8.

Oil drilling and injection activities on the controlled drill site have been undertaken since 1965 in accordance with the terms and conditions of Case No. Z.A. 17528 dated April

29, 1965. Various authorities followed, with the last case on record being a determination of methods and conditions to re-drill one Class "A" well, dated April 22, 2008 in Case No. Z.A. 17528(PA3).

Enclosed as Exhibit 2 is a well path map showing the proposed well corridors and bottom-hole locations for Well #J-45, #J-31RD and #J-32RD.

Applicant hereby requests a determination of the methods and conditions to drill one (1) new Class "B" well and to re-drill one (1) Class "A" well and re-drill one (1) Class "B" oil well to be bottomed as shown on in the following chart:

	Well Number	Oil Drilling District
1	J-45	U-124
2	J-31RD	U-135
3	J-32RD	U-135

Urbanized Oil Drilling District No. U-124 was established by Ordinance No. 129,760. (Exhibit 3 includes copies of all relevant City Ordinance.) Under various authorities, a total of at least 24 Class "A" production wells have been authorized to be drilled and bottomed in U-124. At present, there are nine (9) Class "A" wells actively producing, plus six (6) idle producers. Proposed Well #J-45 is a Class "B" injection well. There is no restriction on the number of injection wells that may be drilled and bottomed in U-124. There are currently six (6) active injectors (Class "B" wells) bottomed in U-124. Applicant requests the authority to drill one (1) new Class "B" injector well, named Well #J-45, to be bottomed in U-124. After proposed Well #J-45 is drilled, there will remain nine (9) active and six (6) idle producers bottomed in U-124.

Urbanized Oil Drilling District No. U-135 was established by Ordinance No. 131,452, which authorized the Zoning Administrator to permit drilling and production from a maximum of six (6) Class "A" wells. Currently, Wells #J-30RD and #J-31 are the only active producers (Class "A" wells) bottomed in U-135. There is also one (1) active injection well (Class "B" well), one (1) idle injection well. Applicant requests authority to re-drill Class "A" Well# J-31 as Well #J-31RD and to re-drill Class "B" well #J-32 as Well #J-32RD. Upon approval of this application and drilling of the proposed well, there will remain a total of two (2) Class "A" wells bottomed in U-135.

Applicant Freeport-McMoRan Oil & Gas is the fee owner of the subject property. However, this fact differs from the ownership shown on the City's ownership records. Applicant, Freeport-McMoRan Oil & Gas acquired the property by merger with Plains Exploration & Production Co on May 31, 2013. (See Certificate of Merger -Exhibit 4.) Plains Exploration & Production Co. acquired the property by merger with Brown PXP Properties, LLC effective December 31, 2008. (See Certificate of Merger – Exhibit 5.) Brown PXP Properties, LLC acquired the property by Grant Deed from Bentley-Simonson, Inc. (See Exhibit 6.). PXP, first as the operator for Brown PXP Properties,

then subsequently as the owner of the drill site, has been a responsible operator with an exemplary safety record with respect to all controlled drill sites within the City. Freeport-McMoRan Oil & Gas, as the surviving entity after the merger, will continue the exemplary safety record established by PXP.

A chronology of the zoning administration cases affecting the controlled drill site and copies of the letters authorizing drilling in those cases, along with copies of all prior Zoning Administration letters of determination are enclosed for ease of reference as Exhibit 7.

We have also included in the application package Plains Exploration & Production Company's Spill Prevention Control and Countermeasure (SPCC) Plan dated January 2011, which will continue to be in effect under the management of Freeport-McMoRan Oil and Gas LLC. (See Exhibit 8.)

The proposed drilling operation will require approximately 90 days to complete from the time drilling begins. In addition, installation and removal of a temporary sound wall will require another 15 days before drilling commences and 15 days following the conclusion of drilling. The sound wall will be in place for 120 days or less.

Once Zoning approval is given, applicant needs time to schedule a drilling rig. Therefore, applicant requests that the time to complete drilling operations granted by the Zoning Administrator pursuant to this application be tolled until initial operations are begun and that Applicant be given two years from the commencement of drilling operations to complete its drilling program.

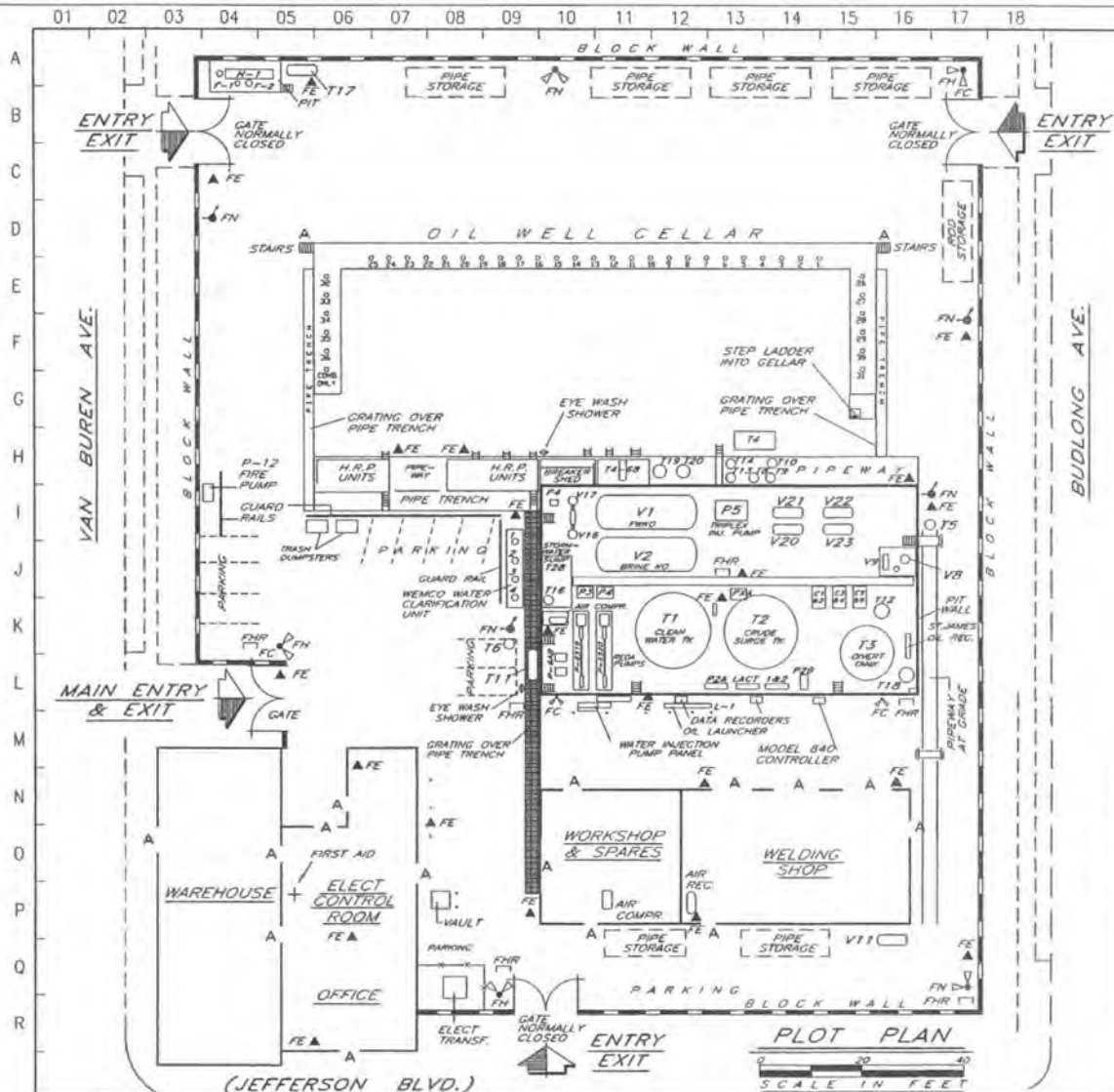
Applicant requests that you approve drilling operations to be conducted 24 hours a day, seven days a week. Such request is consistent with the approval in the original Z.A. Case No. 17528 in 1965, and with the last Plan Approval in Case No. ZA-17528(PA3) on April 22, 2008.

To maintain reasonable noise levels during drilling operations, extensive sound mitigation controls were placed on the controlled drill site in 2006. Condition No. 3 in the Plan Approval dated April 22, 2008 in Case No. Z.A. 17528(PA3) delineates the sound mitigation system and noise controls implemented. A copy of the Drilling Noise and Mitigation Compliance Report of Behrens and Associates, Inc., which demonstrates the successfulness of the mitigation efforts is also attached as Exhibit 9.

Also included are Photos of the Drill Site (Exhibit 10), a Vicinity Map (Exhibit 11), the Assessor Parcel Map (Exhibit 12), the ZIMAS report (Exhibit 13) and the BTC Receipt, Mailing Labels and Perjury Statement (Exhibit 14). For ease of reference, an Exhibit List follows. If there are any other materials required in order to better evaluate this application, please contact Applicant's representative.

Exhibit #	Description
1	Plot Plan
2	Well Path Map
3	City Ordinances
4	Certificate of Merger into Freeport-McMoRan Oil & Gas
5	Certificate of Merger into Plains Exploration & Production Co.
6	Drill Site Deed
7	Zoning Administration Plan Approvals
8	Spill Prevention Control and Countermeasure (SPCC) Plan
9	Sound Report
10	Drill Site Photos
11	Vicinity Map
12	Assessor Parcel Map
13	Zimas Report and Map
14	Mailing Information and Receipt

ZA 17528-P44



ITEM	DESCRIPTION	CAPACITY	CONTENTS (VOLUME %)
T1	STORAGE TANK	1000 BBL	PRODUCED WATER 99%, CRUDE OIL 1%
T2	STORAGE TANK	500 BBL	CRUDE OIL 20-80%, NAT. GAS 20-80%
T3	STORAGE TANK	380 BBL	PRODUCED WATER 99%, CRUDE OIL 1%
T4	STORAGE TANK	500 BBL	PRODUCED WATER 100%
T5	STORAGE TANK	35 GALL	AQUEOUS FOAM
T6	STORAGE TANK	85 GALL	AQUEOUS FOAM
T7	STORAGE TANK	300 GALL	RYKON LUBE OIL
T8	STORAGE TANK	200 GALL	N 9508 WATER CLARIFIER
T9	STORAGE TANK	200 GALL	D 4914 DEMULSIFIER
T10	STORAGE TANK	200 GALL	C 5892 WATER CLARIFIER
T11	STORAGE TANK	1000 GALL	SOLVIT WB 2240 DEGREASER
T12	STORAGE TANK	60 GALL	LUBE OIL
T13	STORAGE TANK	200 GALL	OXYGEN SCANNING 7905
T14	STORAGE TANK	200 GALL	SOLVIT 8678 CLARIFIER
T16	STORAGE TANK	200 GALL	WC 9353 WATER CLARIFIER
T17	STORAGE TANK	1000 GALL	GLYCOL STORAGE
T18	STORAGE TANK	200 GALL	SOLVIT 3890
T19	STORAGE TANK	200 GALL	SCANNING OS 7905
T20	STORAGE TANK	200 GALL	BIOCIDE MPA 7747
V1	F.W. KNOCKOUT DRUM	500 BBL	
V2	HEATER TREATER	500 BBL	
V20	THRU		
V23	TEST SEPARATORS	20 BBL EA	CRUDE OIL 25% PRODUCED WATER 70% GAS 5%
V8	GAS SCRUBBER	-	NATURAL GAS, TRI-ETHYLENE GLYCOL
V9	SEPARATOR	15 BBL	NATURAL GAS
V11	SCRUBBER	15 BBL	NATURAL GAS
V15	SCRUBBER	5 BBL	NATURAL GAS
V17	SCRUBBER	5 BBL	NATURAL GAS



LEGEND

- FN FIRE HYDRANT
- FE FIRE EXTINGUISHER
- FNR FIRE NOSE REEL
- FN FIRE NOZZLE
- FA ACCESS DOORWAY
- FA FIRST AID KIT
- FC FIRE CONNECTION
- ES EYE WASH SHOWER

Business Name: Freaport-McMoran Oil & Gas
Business Address: 1371 W. JEFFERSON BLVD.,
LOS ANGELES, CA 90007
Major Business Activity: OIL AND GAS PRODUCTION

**LAS CIENEGAS FIELD
JEFFERSON SITE**

CONTRACTOR	CONTR. JOB No.
STAINES & ASSOCIATES	
La Habra, California (714) 870-9225	

PLOT PLAN

SCALE: NOTED
DATE: 3-3-03

FRANKPORT-McMoran
Oil & Gas

LAS-B-103

REV	DATE	REVISED	DESIGNED BY	DATE	APP	APPROVED FOR CONSTRUCTION	DATE	BY
1	8-13	GENERAL REVISIONS PER ENBS	SP	50				
2	12-06	SACRTY REVISIONS PER PMP ENBS	SP	50				
3	1-08	ADDED FIRE CONTROL EQUIP. & T17	SP	50				
4	10-08	TANK REVISIONS, ADDED T18 PER ENBS	SP	56				
5	02-09	PLOT PLAN UPDATE PER NP SURVEY	NP	NP				
6	12-09	GENERAL REVISIONS PER ENBS	SP	56				
7	04-10	GENERAL REVISIONS PER ENBS	SP	56				
8	8-11	GENERAL REVISIONS PER ENBS	SP	56				

TAB Y



Jojo Pewsawang <jojo.pewsawang@lacity.org>

opposition to the proposal in ZA Case 17528(PA4)

1 message

Jennifer Redekopp <rhpositive@hotmail.com>

Sun, Nov 23, 2014 at 8:39 PM

To: "jojo.pewsawang@lacity.org" <jojo.pewsawang@lacity.org>, "councilmember.parks@lacity.org" <councilmember.parks@lacity.org>, "councilmember.wesson@lacity.org" <councilmember.wesson@lacity.org>

Dear Zoning Administrator,

Our names are Mark and Jennifer Redekopp and we live on the 2900 block of S. La Salle Avenue, several blocks away from the Freeport-McMoRan Oil and Gas (FMOG) drilling site at the intersections of Jefferson Boulevard and Van Buren Place/Budlong Avenue. Our children are ages 7 and 5 and we have serious environmental health concerns for them and all the other residents of our community. We are writing to oppose activity at the drilling site, specifically the proposal in ZA Case 17528(PA4). We are deeply concerned about the impact of oil drilling activity on our community's health and quality of life. Neighbors living close to the site experience loud noise from the drilling activity. I (Jennifer) visited a neighbor who lives on Van Buren Place in the apartment directly north of the site and tried to have a conversation with him on his front porch. The noise from the site activity made it difficult for us to hear each other speaking. Expanding drilling to 24 hours a day and 7 days a week would make the noise level unacceptable to people who live close to the site. We are also concerned about the effects of chemicals being used at the site. After the most recent acid maintenance done on the wells, there were apparent chemical burns on plants along the property. The dead plants and vines were left in place for over a month. Allowing FMOG to increase activity at the site creates an increased risk of exposure to more acid and toxic chemicals. Another concern is with FMOG's failure to plant street trees on Van Buren Place as required – they have not followed a requirement to plant 50 foot trees on the northwest corner of the property. FMOG has a track record of violating zoning administrator conditions over the years and illegally sold the buffer properties to the north of the site which were meant to keep a safer distance between them and residences. They also have a track record of air quality violations such as failure to notify residents at least 24 hours in advance of acid maintenance.

In light of these concerns, we are writing to request a full Environmental Impact Report (EIR) on the whole site and that FMOG be required to be in full compliance with existing conditions during the EIR.

Sincerely,

Mark and Jennifer Redekopp

TAB Z

City of LA has done little oversight on Jefferson oil drilling site

A City of Los Angeles zoning administrator will consider approval for expanded oil drilling work at the Freeport McMoRan-owned Jefferson Drill Site tomorrow, in what has historically been a routine hearing.

West Adams neighbors who seek full environmental review of operations there say the hearing is anything but.

The dispute draws attention to a not-so-simple question: What's LA's role in regulating oil and gas operations?

The neighborhood groups believe they know. "The purpose of a city, the primary purpose of a city, is to ensure that its residents are safe," says Angela Johnson Meszaros, a lawyer with Physicians for Social Responsibility, who is working with the drill site's neighborhood groups.

Authority over oil production has long been a complex web in urban areas. State law grants authority to the Department of Oil, Gas and Geothermal Resources over subsurface operations.

Regulators at the South Coast Air Quality Management District enforce federal and state laws, and in recent years, have taken an interest in airborne toxic chemicals, requiring operators to disclose their use in some circumstances.

On Budlong Avenue, along the drill site's northeast edge, Jackie Garcia stands in her doorway as fading sun sets blue sky ablaze with pink and orange. She has lived here for years, opposite where they've pulled 7 million barrels of oil from the ground since 1965. Just a few weeks ago she heard that the current owner, Freeport McMoRan, stores acid and other hazardous chemicals on top of drilling.

"It's kind of dangerous, I don't agree with that at all," she says.

A mother of two, Garcia has a third baby on the way. But she's never complained to the city.

"I didn't think that I was – that I had the option," she says.

The city of Los Angeles has always held some authority over oil through the fire department.

"They can ensure that they have inspections from the fire department to make sure that fire safety equipment exists," Meszaros says. "They can ensure that toxic chemicals stored at a site are not close to residential or schools close to a site."

A comprehensive review of Los Angeles Fire Department records for oil operations in West Adams over

the last 60 years doesn't find that the city has done much of that. They reveal only one inspection for the property, in 2011, when an inspector found a mislabeled piece of equipment; remedy was simple.

Later that year, a mishap reported to the state office of Emergency Services sprayed "a fine mist" of oil over a house and onto cars parked along the street. The L.A. Fire Department is listed in state records as the administrative agency, but no records show that the LAFD responded.

Meszaros was surprised. "I guess I thought I would see evidence of the fire department having checked in. at least if not routinely, at least at certain periods of time over the past 50 years," she says."

The city of Los Angeles also holds sway over oil operators through the conditions written into Planning Department-issued permits.

Planning Department officials directed comment about the Jefferson Drill Site to the office of Councilman Bernard Parks, who represents this area. His spokeswoman Kimberly Briggs says, "He's not taking a position on the issue."

How the Planning Department manages drill operations more generally is revealed in a recent report sent to the City Council on the state of oil and gas regulation in Los Angeles.

Its analysis bolsters the arguments of West Adams residents that tracking oil in L.A. is too difficult. "There is no comprehensive way in which to track all oil and gas activity, permits, and their subsequent conditions of approval," the report's author writes.

Over half a century at the Jefferson Drill Site, operations have changed. Pumping pulls up less oil than it did at peak, in the mid-1970s, but more natural gas, and much more brackish water.

But according to the planning department's report, "updates to the code section have not kept time with the changing industry, economy [or] urban environment."

Freeport McMoRan declined an interview. In a statement, the company emphasized that its Jefferson operations are routine and conventional, that questions in the zoning hearing are narrow, and that nothing it's doing deserves environmental review.

But longtime West Adams resident Richard Parks disagrees. In October, he says, Freeport trucked in 20,000 gallons of acid to clean out an injection well – a kind that regional air regulators aren't monitoring.

"And I'll tell you the scariest thing. When they finished this acid job, plants on the northeast corner turned brown and died," Parks says. "They were burned. It looks like hydrochloric acid burns. If this is what Freeport's operations are doing to the plant life. What is it doing to our lungs?"

Until they get answers to that and other questions, Parks and his neighbors say they're going to keep going to every hearing, routine and not.

TAB AA

Published in final edited form as:

Lancet. 2014 April 12; 383(9925): 1325–1332. doi:10.1016/S0140-6736(13)61613-X.

Auditory and non-auditory effects of noise on health

Mathias Basner, MD,

Unit for Experimental Psychiatry, Division of Sleep and Chronobiology, Department of Psychiatry, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, USA

Wolfgang Babisch, PhD,

Department of Environmental Hygiene, Federal Environment Agency, Berlin, Germany

Prof. Adrian Davis, PhD,

Public Health England, Wellington House, Waterloo Road, London, UK. Ear Institute, University College, London, UK

Mark Brink, PhD,

D-MTEC Public and Organizational Health, ETH Zurich, Zurich, Switzerland

Charlotte Clark, PhD,

Centre for Psychiatry, Wolfson Institute of Preventive Medicine, Barts and London School of Medicine and Dentistry, Queen Mary University of London, UK

Sabine Janssen, PhD, and

Department of Urban Environment and Safety, TNO (Netherlands Organization for Applied Scientific Research), Delft, Netherlands

Prof. Stephen Stansfeld, PhD

Centre for Psychiatry, Wolfson Institute of Preventive Medicine, Barts and London School of Medicine and Dentistry, Queen Mary University of London, UK

Abstract

Noise is pervasive in everyday life and can cause both auditory and non-auditory health effects. Noise-induced hearing loss remains highly prevalent in occupational settings, and is increasingly caused by social noise exposure (eg, through personal music players). Our understanding of molecular mechanisms involved in noise-induced hair-cell and nerve damage has substantially increased, and preventive and therapeutic drugs will probably become available within 10 years. Evidence of the non-auditory effects of environmental noise exposure on public health is growing.

Correspondence to: Dr Mathias Basner, Unit for Experimental Psychiatry, Division of Sleep and Chronobiology, Department of Psychiatry, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA 19104–6021, USA, basner@upenn.edu.

Contributors

MBA wrote the abstract, the section about noise effects on sleep, and the conclusion; did a literature search for the section about noise effects on sleep; contributed panel 2; and helped to design figure 1. WB wrote the introduction to the section about non-auditory health effects; did the literature search for and wrote the section on cardiovascular noise effects; and contributed figures 2 and 3. AD did the literature search for and wrote the chapter on auditory effects of noise on health. MBR did the literature search for and wrote the section on the effects of hospital noise. CC did the literature search for and wrote the section on the effects of noise on cognitive performance. SJ did the literature search for and wrote the section on community effects of noise. SS wrote the introduction. All authors read and revised the Review.

Conflicts of interest

We declare that we have no conflicts of interest.

Observational and experimental studies have shown that noise exposure leads to annoyance, disturbs sleep and causes daytime sleepiness, affects patient outcomes and staff performance in hospitals, increases the occurrence of hypertension and cardiovascular disease, and impairs cognitive performance in schoolchildren. In this Review, we stress the importance of adequate noise prevention and mitigation strategies for public health.

Introduction

Evolution has programmed human beings to be aware of sounds as possible sources of danger.¹ Noise, defined as unwanted sound, is a pollutant whose effects on health have been neglected, despite the ability to precisely measure or calculate exposure from peak levels or energy averaged over time (panel 1, figure 1). Although people tend to habituate to noise exposure, degree of habituation differs for individuals and is rarely complete.² If exposure to noise is chronic and exceeds certain levels, then negative health outcomes can be seen. Health effects were first recognised in occupational settings, such as weaving mills, where high levels of noise were associated with noise-induced hearing loss.³ Occupational noise is the most frequently studied type of noise exposure. Research focus has broadened to social noise (eg, heard in bars or through personal music players) and environmental noise (eg, noise from road, rail, and air traffic, and industrial construction). These noise exposures have been linked to a range of non-auditory health effects including annoyance,⁴ sleep disturbance,⁵ cardiovascular disease,^{6,7} and impairment of cognitive performance in children.⁸ The health effects of noise from entertainment venues and from neighbours are elusive, but nevertheless, cause many complaints to local authorities. The meaning attributed to sounds might affect our response to them—eg, the response to aircraft noise might differ between an airport employee and a resident who fears long-term health consequences due to the noise exposure. Noise is pervasive in urban environments and the availability of quiet places is decreasing. In the European Union, about 56 million people (54%) living in areas with more than 250 000 inhabitants are exposed to road traffic noise of more than average L_{DEN} 55 dB per year, which is thought to be risky to health.⁹ Thus, understanding of occupational and environmental noise is important for public health. In this Review, we summarise knowledge and research related to noise exposure and both auditory and non-auditory health effects.

Panel 1

Glossary of terms used to describe sound

Sound pressure level	Sound pressure level is a logarithmic measure of the effective pressure of a sound relative to a reference value. It is measured in decibels (dB, see below) higher than a reference level. The reference sound pressure in air is 20 μ Pa (2×10^{-5} Pa), which is thought to be the human hearing threshold at a sound frequency of 1000 Hz.
dB scale	A logarithmic scale to measure sound pressure level. A two-fold increase in sound energy (eg, two identical jackhammers instead of one) will cause the sound pressure level to increase by 3 dB. A ten-

	fold increase in sound energy (10 jackhammers) will cause the sound pressure level to increase by 10 dB, which is perceived as about twice as loud.
L_{\max}	The highest sound pressure level in a given time period.
L_{eq}	Average level of sound pressure within a certain time period. If the A-filter is used for frequency-weighting (figure 1), the average level is referred to as L_{Aeq} . The filter and time period used for averaging are often indicated in subscript—eg, $L_{\text{Aeq}8\text{h}}$, $L_{\text{Aeq}23-7\text{h}}$, or L_{night} .
L_{DEN}	L_{DEN} (Day-Evening-Night-Level), also referred to as DENL, is the A-filtered average sound pressure level, measured over a 24 h period, with a 10 dB penalty added to the night (2300–0700 h or 2200–0600 h, respectively), and a 5 dB penalty added to the evening period (1900–2300 h or 1800–2200 h, respectively), and no penalty added to the average level in the daytime (0700–1900 h or 0600–1800 h, respectively). The L_{DN} measure is similar to the L_{DEN} , but omits the 5 dB penalty during the evening period. The penalties are introduced to indicate people's extra sensitivity to noise during the night and evening. Both L_{DEN} and L_{DN} are based on A-weighted sound pressure levels, although this factor is not usually indicated in subscript.

Auditory health effects

Noise-induced hearing loss

Noise is the major preventable cause of hearing loss. Noise-induced hearing loss can be caused by a one-time exposure to an intense impulse sound (such as gunfire), or by steady state long-term exposure with sound pressure levels higher than L_A 75–85 dB—eg, in industrial settings. The characteristic pathological feature of noise-induced hearing loss is the loss of auditory sensory cells in the cochlea. Because these hair cells cannot regenerate in mammals, no remission can occur; prevention of noise-induced hearing loss is the only option to preserve hearing. Hearing loss leading to the inability to understand speech in everyday situations can have a severe social effect. It can also affect cognitive performance and decrease attention to tasks. Accidents and falls are also associated with undiagnosed hearing loss, with excess mortality of 10–20% in 20 years.¹⁰

Noise-induced hearing loss is a public health problem. Global Burden of Disease 2010¹¹ estimated that 1·3 billion people are affected by hearing loss and investigators rated hearing loss as the 13th most important contributor (19·9 million years, 2·6% of total number) to the global years lived with disability (YLD). Adult-onset hearing loss unrelated to a specific disease process accounted for 79% of YLD from hearing loss. In the USA and Europe, 26% of adults have a bilateral hearing disorder that impairs their ability to hear in noisy environments, and a further 2% have substantial unilateral hearing issues. Age-adjusted

prevalence is similar in Asia.¹² WHO estimates that 10% of the world population is exposed to sound pressure levels that could potentially cause noise-induced hearing loss. In about half of these people, auditory damage can be attributed to exposure to intense noise.¹³

Search strategy and selection criteria

We searched PubMed, Science Citation Index Expanded, and Social Sciences Citation Index, and references from relevant articles for English language articles from Jan 1, 1980, to Feb 1, 2013, using the search terms: “hearing loss”, “tinnitus”, “annoyance”, “cardiovascular disease”, “hypertension”, “high blood pressure”, “myocardial infarction”, “stroke”, “sleep”, “cognitive performance”, “reading ability”, and “hospital”, in combination with “noise”. Each author did their own search, and is also a subject matter expert in their field. We focused on articles published in the past 5 years; however, used older articles if they represent seminal research or are necessary to understand more recent findings. We included reports from recent meetings if we regarded them to be relevant.

Tinnitus—ie, change in sound perception, such as ringing, that cannot be attributed to an external source—often follows acute and chronic noise exposure, and persists in a high proportion of affected individuals for extended periods.¹⁴ Tinnitus can affect quality of life in several ways, including through sleep disturbance, depression, or the inability to sustain attention.¹⁵ The fact that hearing loss and tinnitus are reported in combination suggests that both symptoms share common pathophysiological pathways.

Occupational noise-induced hearing loss

Despite the introduction of standards for hearing protection, reduction in occupational noise exposure in developed countries, and extensive public health efforts, hearing loss induced by exposure to occupational noise remains a dilemma and is the focus of extensive research. Noise-induced hearing is the most common occupational disease in the USA: about 22 million US workers are exposed to hazardous noise levels at work, and, annually, an estimated US\$242 million is spent on compensation for hearing loss disability.¹⁶

Many countries enforce general health and safety legislation that specifies maximum exposure levels and requirements for action, including noise assessments, regular audiometric testing, protective equipment, and monitoring, which are intended to protect both workers and the public from excessive noise exposure. However, the available evidence for associations between occupational noise exposure and hearing loss is complex and its quality varies. Many studies have a lack of appropriate non-exposed controls, and longitudinal studies are scarce. Contributors to a Cochrane collaboration review¹⁷ concluded that “higher quality prevention programs, better quality of studies especially in the field of engineering controls and better implementation of legislation are needed to better prevent noise-induced hearing loss”. This Review also indicated that current efforts for hearing loss prevention focus on hearing protection rather than on noise control.

The exact level of noise exposure in industrial settings that carries risk of hearing damage is debated internationally. For example, in the UK, the Control of Noise at Work Regulations

(2005)¹⁸ set levels for action at L_{Aeq8h} 80 dB (protection made available) and 85 dB (protection mandatory). A 3 year follow-up investigation of 19 UK companies that had varying degrees of compliance reported that these values were safe.¹⁹ However, studies with a longer follow-up are needed to lend support to these findings. The US Occupational Safety and Health Administration (OSHA) promotes less strict standards than do others and sets the permissible exposure limit at L_{Aeq8h} 90 dB. However, according to OSHA regulations, employers have to implement a hearing conservation programme if workers are exposed to levels higher than L_{Aeq8h} 85 dB. Although noise-induced hearing loss is well recognised in industrial settings, individuals with other occupations such as musicians^{20,21} or those working for the military,^{22,23} also contribute substantially to the overall burden of noise-induced hearing loss.

Social noise exposure

Excessive noise is often accepted as part of the recreational environment. Although occupational noise has decreased since the early 1980s, the number of young people with relevant degrees of social noise exposure has tripled in the same period.²⁴ A growing body of work is assessing the risk of hearing loss in adolescents due to personal music player use.²⁵ In one study, 66% of young adults attending nightclubs or rock concerts in the Nottingham area of England reported temporary auditory effects or tinnitus.²⁴ Prospective cohort studies like OHRKAN²⁶ are needed to conclude whether widespread exposure to loud music in adolescence increases the prevalence of hearing loss and tinnitus in older ages. Both safer products and public health campaigns are needed to reduce the risk of hearing loss from personal music player use. Noise-cancelling headphones are effective preventive measures for reducing hazards for users of personal music players.²⁷

Noise-induced hearing loss and age

Noise-induced hearing loss is determined by noise exposure and life-course events, all age groups can be affected. Exposure to different types of noise from early childhood might have cumulative effects on hearing impairment in adulthood. Evidence is increasing that early social and biological factors might affect hearing in middle age (eg, a study of patients assessed at age 45 years²⁸). Prevalence of hearing loss is highly related to age.²⁹ How noise and age interact is a major gap in the specialty's knowledge. Data suggest that pathological but sublethal changes from early noise exposure substantially increase risk of inner ear ageing and related hearing loss.^{30,31} In addition to noise, factors such as alcohol and tobacco use and hyperglycaemia are associated with age-related hearing loss. Thus, public health initiatives need to address both general health and auditory health.

Scientific advances and therapeutic strategies

In the past 5 years, several studies and advances have improved understanding of the causes and factors affecting susceptibility to noise-induced hearing loss. Noise-induced hearing loss is widely accepted to be a symptom of a complex disease that results from the interaction of genetic and environmental factors. Heritability might explain up to 50% of hearing loss variability in individuals after exposure to noise, but definitive studies are needed. Identification of susceptibility genes might help to identify the population at high risk and improve targeted hearing protection in predisposed individuals.³² Much progress has been

made in the understanding of molecular mechanisms involved in hair-cell and nerve damage. Recent research from investigators using stem cells to recover the damaged sensory circuitry in the cochlea is at a very early stage, but could lead to potential therapeutic strategies.³³ Attention is increasing on the risks of combined exposure to high-level noise and ototoxic drugs, which can affect the structures of the inner ear and the auditory nerves.^{34,35} A small but substantial number of people have hearing loss as a complication of cancer treatments such as cisplatin, which might be further exacerbated by high levels of noise (eg, in MRI scanners).

Several therapeutic avenues have been recently explored, and oral drugs to protect against noise-induced hearing loss are expected to become available in the next 10 years.¹³ Investigators have reported that oxidative stress could contribute to cochlear cell damage; antioxidant compounds, such as glutathione, have improved noise-induced hearing loss in animals and might prevent noise-induced hearing loss.^{36,37} An oral otoprotective drug, D-methionine, prevents noise-induced hearing loss in animals even when first given within hours after a noise exposure; however, only formal clinical trials will provide the data needed to assess safety and efficacy in human beings.³⁸ Clinical trials of D-methionine in the US Army, funded by the US Department of Defense, are scheduled to begin soon (NCT01345474).³⁸

Diagnosis of noise-induced hearing loss

The development of otoacoustic emission testing has been an important technological advance in audiological assessment. Otoacoustic emissions are a release of acoustic energy from the cochlea that can be recorded in the ear canal. Otoacoustic emission testing is used to identify hearing defects in newborn babies and young children. Hall and Lutman³⁹ reported that otoacoustic emission testing was twice as sensitive as was audiometry to detect a change in hearing threshold level and suggested that it could improve monitoring for noise-induced hearing loss in the workplace. A longitudinal study⁴⁰ also suggested that otoacoustic emissions could indicate noise-induced changes in the inner ear undetected by audiometric tests. Otoacoustic emissions might therefore be a superior diagnostic predictor for noise-induced hearing loss, but further longitudinal studies are needed to show whether otoacoustic emission testing can replace standard audiometry or whether the two techniques have complementary roles.¹⁹

Non-auditory health effects

Introduction

The most investigated non-auditory health endpoints for noise exposure are perceived disturbance and annoyance, cognitive impairment (mainly in children), sleep disturbance, and cardiovascular health. WHO estimated that in high-income western European countries (population about 340 million people), at least 1 million healthy life-years (disability-adjusted life-years) are lost every year because of environmental noise (figure 2).¹⁴

Annoyance

Annoyance is the most prevalent community response in a population exposed to environmental noise. Noise annoyance can result from noise interfering with daily activities, feelings, thoughts, sleep, or rest, and might be accompanied by negative responses, such as anger, displeasure, exhaustion, and by stress-related symptoms.⁴¹ In severe forms, it could be thought to affect wellbeing and health, and because of the high number of people affected, annoyance substantially contributes to the burden of disease from environmental noise (figure 2).¹⁴ Investigators have proposed standardised questions about residents' long-term annoyance in their home for use in surveys.⁴² Additionally, investigators have gathered substantial data for community annoyance in residents exposed to noise in their home, based on which exposure–response relationships were derived (eg, for wind turbines).^{4,43,44} These relations can be used in strategic or health impact assessments for estimating long-term annoyance in fairly stable situations. Although the overall community response depends on societal values and is most relevant to the guidance of policy, several personal (eg, age and noise sensitivity) and situational characteristics (eg, dwelling insulation) might affect the individual degree of annoyance.^{41,44}

Cardiovascular disease

Both short-term laboratory studies of human beings and long-term studies of animals have provided biological mechanisms and plausibility for the theory that long-term exposure to environmental noise affects the cardiovascular system and causes manifest diseases (including hypertension, ischaemic heart diseases, and stroke).⁴⁵ Acute exposure to different kinds of noise is associated with arousals of the autonomic nervous system and endocrine system.⁴⁶ Investigators have repeatedly noted that noise exposure increases systolic and diastolic blood pressure, changes heart rate, and causes the release of stress hormones (including catecholamines and glucocorticoids).⁴⁵ The general stress model is the rationale behind these reactions. Potential mechanisms are emotional stress reactions due to perceived discomfort (indirect pathway), and non-conscious physiological stress from interactions between the central auditory system and other regions of the CNS (direct pathway). The direct pathway might be the predominant mechanism in sleeping individuals, even at low noise levels.

Chronic exposure can cause an imbalance in an organism's homeostasis (allostatic load), which affects metabolism and the cardiovascular system, with increases in established cardiovascular disease risk factors such as blood pressure, blood lipid concentrations, blood viscosity, and blood glucose concentrations.^{45,47} These changes increase the risk of hypertension, arteriosclerosis, and are related to severe events, such as myocardial infarction and stroke. Studies of occupational^{48–50} and environmental^{7,51–53} epidemiology have shown a higher prevalence and incidence of cardiovascular diseases and mortality in highly noise-exposed groups. The risk estimates for occupational noise at ear-damaging intensities tend to be higher than are those for environmental noise (at lower noise levels). Because of different acoustic characteristics for different noise sources (sound level, frequency spectrum, time course, sound level rise time, and psycho-acoustic measures) noise levels from different noise sources cannot be merged into one indicator of decibels. Different exposure–response curves are needed for different noise sources. Meta-analyses were done to quantitatively

assess the exposure–response link for transportation noise (exposure to road traffic and aircraft noise) and health effects (hypertension and ischaemic heart diseases, including myocardial infarction).^{6,54,55} The investigators derived increases in risk of between 7% and 17% per 10 dB increase in equivalent noise level L_{Aeq} (figure 3). Their results have been adjusted for known risk factors such as age, sex, socioeconomic status, smoking, body-mass index, and others. The researchers identified sex and age as effect modifiers. Studies of the combined effects of noise and air pollution showed largely independent effects,^{7,51–53} which can be explained by different mechanisms of how both exposures can affect health (cognitive and autonomic stress response vs inflammatory processes).

Cognitive performance

WHO estimate that about 45 000 disability-adjusted life-years are lost every year in high-income western European countries for children aged 7–19 years because of environmental noise exposure (figure 2).¹⁴ Postulated mechanisms for noise effects on children's cognition include communication difficulties, impaired attention, increased arousal, learned helplessness, frustration, noise annoyance, and consequences of sleep disturbance on performance.^{3,56} Investigators have also suggested psychological stress responses as a mechanism because children are poor at appraising threats from stressors and have less well developed coping strategies than do adults.³ Areas with high levels of environmental noise are often socially deprived, and children from areas with high social deprivation do worse on tests of cognition than do children not exposed to social deprivation. Therefore, measures of socioeconomic position should be taken into account in the assessment of associations between noise exposure and health and cognition.

More than 20 studies have shown environmental noise exposure has a negative effect on children's learning outcomes and cognitive performance,⁵⁷ and that children with chronic aircraft, road traffic, or rail noise exposure at school have poorer reading ability, memory, and performance on national standardised tests than do children who are not exposed to noise at school.^{58–60} Investigators have examined exposure–effect links between noise exposure and cognition to identify the exposure level at which noise effects begin.^{61,62} The RANCH study of 2844 children aged 9–10 years attending 89 schools around Heathrow (London, UK), Schiphol (Amsterdam, the Netherlands), and Madrid-Barajas (Spain) airports showed a linear exposure–effect relation between aircraft noise exposure at school and a child's reading comprehension and recognition memory after adjusting for a range of socioeconomic factors.^{61,62} A L_{Aeq} 5 dB increase in aircraft noise exposure was associated with a 2 month delay in reading age in children in the UK and a 1 month delay in those in the Netherlands. These linear associations suggest that there is no threshold for effects and any reduction in noise level at school should improve a child's cognition.

WHO Community Noise Guidelines⁶³ suggest that the background sound pressure level should not exceed L_{Aeq} 35 dB during teaching sessions. Intervention studies and natural experiments have shown that reductions in noise exposure from insulation or the closure of airports are associated with improvements in cognition, suggesting that noise reduction can eliminate noise effects on cognition.^{58,59}

Sleep disturbance

Sleep disturbance is thought to be the most deleterious non-auditory effect of environmental noise exposure (figure 2), because undisturbed sleep of a sufficient length is needed for daytime alertness and performance, quality of life, and health.^{5,14} Human beings perceive, evaluate, and react to environmental sounds, even while asleep.⁶⁴ Maximum sound pressure levels as low as L_{Amax} 33 dB can induce physiological reactions during sleep including autonomic, motor, and cortical arousals (eg, tachycardia, body movements, and awakenings).^{5,65} Whether noise will induce arousals depends not only on the number of noise events and their acoustical properties,² but also on situational moderators (such as momentary sleep stage⁶⁶) and individual noise susceptibility.⁶⁴ Elderly people, children, shift-workers, and people with a pre-existing (sleep) disorder are thought of as at-risk groups for noise-induced sleep disturbance.⁵ Repeated noise-induced arousals interfere with sleep quality through changes in sleep structure, which include delayed sleep onset and early awakenings, reduced deep (slow-wave) and rapid eye movement sleep, and an increase in time spent awake and in superficial sleep stages.^{2,66} However, these effects are not specific for noise,⁶⁷ and generally less severe than those in clinical sleep disorders such as obstructive sleep apnoea.⁶⁸ Short-term effects of noise-induced sleep disturbance include impaired mood, subjectively and objectively increased daytime sleepiness, and impaired cognitive performance.^{69,70} Results of epidemiological studies indicate that nocturnal noise exposure might be more relevant for the creation of long-term health outcomes such as cardiovascular disease than is daytime noise exposure,⁷¹ probably because of repeated autonomic arousals that have been shown to habituate to a much lesser degree to noise than other—eg, cortical—arousals.² In 2009, WHO published the Night Noise Guidelines for Europe, an expert consensus mapping four noise exposure groups to negative health outcomes ranging from no substantial biological effects to increased risk of cardiovascular disease (panel 2).⁷² WHO regards average nocturnal noise levels of less than $L_{Aeq, outside}$ 55 dB to be an interim goal and 40 dB a long-term goal for the prevention of noise-induced health effects.

Panel 2

WHO definitions of health effects of different average night noise levels⁷²

Below 30 dB $L_{Aeq, night, outside}$	Although individual sensitivities and circumstances may differ, it appears that up to this level no substantial biological effects are observed. $L_{A, eq, night, outside}$ of 30 dB is equivalent to the no observed effect level (NOEL) for night noise.
30–40 dB $L_{Aeq, night, outside}$	A number of effects on sleep are observed from this range: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example children, the chronically ill, and elderly people) are more susceptible. However, even in

	the worst cases the effects seem modest. $L_{A,eq,night,outside}$ of 40 dB is equivalent to the lowest observed adverse effect level (LOAEL) for night noise.
40–55 dB $L_{Aeq,night,outside}$	Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.
Above 55 dB $L_{Aeq,night,outside}$	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases.

Hospital noise

Although most environmental noise guidelines list hospitals as noise-sensitive facilities, studies of external (eg, traffic) noise effects on hospital environments are very rare. However, research on the understanding and prevention of indoor hospital noise effects on patients and staff has been increasing. An extensive meta-analysis of hospital sound levels indicated that hospital noise has increased by about L_{Aeq} 10 dB since the 1960s.⁷³ Noise levels in hospitals are now typically more than L_{Aeq} 15–20 dB higher than those recommended by WHO.⁶³ Hospital noise could therefore be an increasing threat to patient rehabilitation and staff performance.

The sound environment in hospitals, especially in intensive care units, can be characterised by irregularly occurring noises from sources such as medical devices (eg, alarms), telephones or pagers, conversations, door sounds, and nursing activities. Such noise worsens patient health outcomes through factors such as increased cardiovascular stress, longer healing times, increases in doses of pain-relief drugs, and increased patient readmission rates.⁷⁴ Neonates, long-term patients, and elderly people are thought to be particularly at-risk to the effects of noise. Sleep disruption is the most common noise-related patient complaint.^{75,76} Researchers of a sleep laboratory study developed arousal probability curves for 14 noises typically encountered in hospitals.⁷⁷ The most disturbing noises were intravenous pump alarms and telephone rings, which are intentionally designed to alert staff members.

Evidence of negative effects of noise on hospital staff is increasing, particularly for nurses, with noise-induced stress linked to burnout, diminished wellbeing, and reduced work performance.⁷⁸ Substantial proportions of staff report annoyance, irritation, fatigue, and tension headaches, which they assign to the noisy workplace environment.⁷⁹ Noise also affects speech intelligibility and could therefore lead to misunderstandings that result in medical errors.^{73,78}

Improved acoustics such as sound-absorbing ceilings are relevant factors for staff performance and reduced work strain,⁸⁰ and have been associated with a decrease in rates of patients being readmitted to hospital.⁷⁴ Reduction of background sound levels and ringtone volume of telephones is recommended to improve patient recovery at night.⁷⁷ Researchers noted promise in reductions of rates of false alarms of medical devices and modification of staff behaviour to avoid unnecessary noise.⁸¹

Conclusions

Hearing loss caused by occupational or recreational noise exposure is highly prevalent and constitutes a public health threat needing preventive and therapeutic strategies. In this Review, we emphasise that non-auditory health effects of environmental noise are manifold, serious and, because of the widespread exposure, very prevalent. These factors stress the need to regulate and reduce environmental noise exposure (ideally at the source) and to enforce exposure limits to mitigate negative health consequences of chronic exposure to environmental noise. Educational campaigns for children and adults can promote both noise-avoiding and noise-reducing behaviours, and thus, mitigate negative health consequences. Efforts to reduce noise exposure will eventually be rewarded by lower amounts of annoyance, improved learning environments for children, improved sleep, lower prevalence of cardiovascular disease, and, in the case of noise exposure in hospitals, improved patient outcomes and shorter hospital stays.

Acknowledgments

We thank Dietmar Wurzel for designing and providing figure 1. MBA is partly funded by National Institutes of Health grant NR004281. CC is a member of the Airports Commission's External Advisory Panel in the UK. SS is a member of the Acoustics Review Group for ARUP High Speed Two (HS2).

References

1. Hughes RW, Jones DM. Indispensable benefits and unavoidable costs of unattended sound for cognitive functioning. *Noise Health*. 2003; 6:63–76. [PubMed: 14965454]
2. Basner M, Müller U, Elmenhorst EM. Single and combined effects of air, road, and rail traffic noise on sleep and recuperation. *Sleep*. 2011; 34:11–23. [PubMed: 21203365]
3. Stansfeld S, Haines M, Brown B. Noise and health in the urban environment. *Rev Environ Health*. 2000; 15:43–82. [PubMed: 10939085]
4. Miedema HME, Oudshoorn CGM. Annoyance from transportation noise: relationships with exposure metrics DNL and DENL and their confidence intervals. *Environ Health Perspect*. 2001; 109:409–16. [PubMed: 11335190]
5. Muzet A. Environmental noise, sleep and health. *Sleep Med Rev*. 2007; 11:135–42. [PubMed: 17317241]
6. van Kempen E, Babisch W. The quantitative relationship between road traffic noise and hypertension: a meta-analysis. *J Hypertens*. 2012; 30:1075–86. [PubMed: 22473017]
7. Sørensen M, Andersen ZJ, Nordsborg RB, et al. Road traffic noise and incident myocardial infarction: a prospective cohort study. *PLoS One*. 2012; 7:e39283. [PubMed: 22745727]
8. Stansfeld SA, Matheson MP. Noise pollution: non-auditory effects on health. *Br Med Bull*. 2003; 68:243–57. [PubMed: 14757721]
9. Babisch, W. Exposure to environmental noise: risks for health and the environment. Workshop on “sound level of motor vehicles”. Directorate General for Internal Policies of the European

Parliament; Brussels: 2012. <http://www.europarl.europa.eu/document/activities/cont/201205/20120524ATT45762/20120524ATT45762EN.pdf> [accessed July 11, 2013]

10. Karpa MJ, Gopinath B, Beath K, et al. Associations between hearing impairment and mortality risk in older persons: the Blue Mountains Hearing Study. *Ann Epidemiol.* 2010; 20:452–59. [PubMed: 20470972]
11. Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012; 380:2163–96. [PubMed: 23245607]
12. Fuente A, Hickson L. Noise-induced hearing loss in Asia. *Int J Audiol.* 2011; 50 (suppl):S3–10. [PubMed: 21288065]
13. Oishi N, Schacht J. Emerging treatments for noise-induced hearing loss. *Expert Opin Emerg Drugs.* 2011; 16:235–45. [PubMed: 21247358]
14. Fritschi, L.; Brown, AL.; Kim, R.; Schwela, DH.; Kephapopoulos, S., editors. *Burden of disease from environmental noise.* Bonn: World Health Organization; 2011.
15. Davis, A.; El Refaie, A. The epidemiology of tinnitus. In: Tyler, R., editor. *Tinnitus handbook.* Hampshire: Cengage Learning; 2000. p. 1–23.
16. National Institute for Occupational Safety and Health (NIOSH). [accessed July 11, 2013] noise and hearing loss prevention. 2013. <http://www.cdc.gov/niosh/topics/noise/>
17. Verbeek JH, Kateman E, Morata TC, Dreschler WA, Mischke C. Interventions to prevent occupational noise-induced hearing loss. *Cochrane Database Syst Rev.* 2012; 10:CD006396. [PubMed: 23076923]
18. Stationery Office. [accessed July 11, 2013] The Control of Noise at Work Regulations. 2005. <http://www.legislation.gov.uk/ukxi/2005/1643/contents/made>
19. Lutman, ME.; Davis, A.; Ferguson, M. [accessed July 11, 2013] Epidemiological evidence for the effectiveness of the noise at work regulations. 2008. <http://www.hse.gov.uk/research/rrpdf/rr669.pdf>
20. Schmidt JH, Pedersen ER, Juhl PM, et al. Sound exposure of symphony orchestra musicians. *Ann Occup Hyg.* 2011; 55:893–905. [PubMed: 21841154]
21. Jansen EJM, Helleman HW, Dreschler WA, de Laat JA. Noise induced hearing loss and other hearing complaints among musicians of symphony orchestras. *Int Arch Occup Environ Health.* 2009; 82:153–64. [PubMed: 18404276]
22. Muhr P, Rosenhall U. The influence of military service on auditory health and the efficacy of a Hearing Conservation Program. *Noise Health.* 2011; 13:320–27. [PubMed: 21768736]
23. Yankaskas K. Prelude: noise-induced tinnitus and hearing loss in the military. *Hear Res.* 2013; 295:3–8. [PubMed: 22575206]
24. Smith PA, Davis A, Ferguson M, Lutman ME. The prevalence and type of social noise exposure in young adults in England. *Noise Health.* 2000; 2:41–56. [PubMed: 12689478]
25. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) of the European Commission. [accessed July 11, 2013] Potential health risks of exposure to noise from personal music players and mobile phones including a music playing function. 2008. http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_017.pdf
26. Twardella D, Perez Alvarez C, Steffens T, Fromme H, Raab U. Hearing loss in adolescents due to leisure noise. The OHRKAN study. *Bundesgesundheitsbla.* 2011; 54:965–71.
27. Liang MJ, Zhao F, French D, Zheng YQ. Characteristics of noise-canceling headphones to reduce the hearing hazard for MP3 users. *J Acoust Soc Am.* 2012; 131:4526–34. [PubMed: 22712926]
28. Ecob R, Russ S, Davis A. BMI over the lifecourse and hearing ability at age 45 years: a population based study. *Longit Life Course Stud.* 2011; 2:242–59.
29. Davis A, Smith P, Ferguson M, Stephens D, Gianopoulos I. Acceptability, benefit and costs of early screening for hearing disability: a study of potential screening tests and models. *Health Technol Assess.* 2007; 11:1–294.
30. Kujawa SG, Liberman MC. Acceleration of age-related hearing loss by early noise exposure: evidence of a misspent youth. *J Neurosci.* 2006; 26:2115–23. [PubMed: 16481444]

31. Campo P, Venet T, Rumeau C, et al. Impact of noise or styrene exposure on the kinetics of presbycusis. *Hear Res.* 2011; 280:122–32. [PubMed: 21616132]
32. Sliwinska-Kowalska, M. Contribution of genetic factors to noise-induced hearing loss. In: Griefahn, B., editor. 10th international congress on noise as a public health problem of the international commission on biological effects of noise; London, UK. 2011. <http://www.icben.org/proceedings.html>
33. Chen W, Jongkamonwivat N, Abbas L, et al. Restoration of auditory evoked responses by human ES-cell-derived otic progenitors. *Nature.* 2012; 490:278–82. [PubMed: 22972191]
34. Campo, P.; Maguin, K.; Gabriel, S., et al. [accessed July 11, 2013] Combined exposure to noise and ototoxic substances. European Agency for Safety and Health at Work (EU-OSHA). 2009. https://osha.europa.eu/en/publications/literature_reviews/combined-exposure-to-noise-and-ototoxic-substances
35. Johnson, A-C.; Morata, TC. The Nordic Expert Group for Criteria Documentation of Health Risks from Chemicals: Occupational exposure to chemicals and hearing impairment. Gothenburg, Sweden: 2010. https://gupea.ub.gu.se/bitstream/2077/23240/1/gupea_2077_23240_1.pdf [accessed July 11, 2013]
36. Le Prell CG, Dolan DF, Bennett DC, Boxer PA. Nutrient plasma levels achieved during treatment that reduces noise-induced hearing loss. *Transl Res.* 2011; 158:54–70. [PubMed: 21708356]
37. Le Prell, CG.; Spankovich, C. Healthy diets and dietary supplements: recent changes in how we might think about hearing conservation. In: Griefahn, B., editor. 10th International Congress on Noise as a Public Health Problem of the International Commission on Biological Effects of Noise; London, UK. 2011. <http://www.icben.org/proceedings.html>
38. Campbell, KCM. Oral pharmacologic otoprotective agents to prevent noise-induced hearing loss (NOISE-INDUCED HEARING LOSS): when dietary concentration isn't enough. In: Griefahn, B., editor. 10th International Congress on Noise as a Public Health Problem of the International Commission on Biological Effects of Noise; London, UK. 2011. <http://www.icben.org/proceedings.html>
39. Lutman, ME.; Hall, AJ. Novel methods for early identification of noise-induced hearing loss. Sudbury: HSE Books; 2000.
40. Lapsley Miller JA, Marshall L, Heller LM, Hughes LM. Low-level otoacoustic emissions may predict susceptibility to noise-induced hearing loss. *J Acoust Soc Am.* 2006; 120:280–96. [PubMed: 16875225]
41. Ohrstrom E, Skanberg A, Svensson H, Gidlof-Gunnarsson A. Effects of road traffic noise and the benefit of access to quietness. *J Sound Vibrat.* 2006; 295:40–59.
42. Fields JM, De Jong RG, Gjestland T, et al. Standardized general-purpose noise reaction questions for community noise surveys: research and a recommendation. *J Sound Vibrat.* 2001; 242:641–79.
43. Fidell S, Mestre V, Schomer P, et al. A first-principles model for estimating the prevalence of annoyance with aircraft noise exposure. *J Acoust Soc Am.* 2011; 130:791–806. [PubMed: 21877795]
44. Janssen SA, Vos H, Eisses AR, Pedersen E. A comparison between exposure-response relationships for wind turbine annoyance and annoyance due to other noise sources. *J Acoust Soc Am.* 2011; 130:3746–53. [PubMed: 22225031]
45. Babisch, W. Cardiovascular effects of noise. In: Nriagu, JO., editor. *Encyclopedia of Environmental Health.* Burlington: Elsevier; 2011. p. 532–42.
46. Lusk SL, Gillespie B, Hagerty BM, Ziemba RA. Acute effects of noise on blood pressure and heart rate. *Arch Environ Health.* 2004; 59:392–99. [PubMed: 16268115]
47. Babisch W. Cardiovascular effects of noise. Editorial. *Noise Health.* 2011; 13:201–04. [PubMed: 21537102]
48. van Kempen EEMM, Kruize H, Boshuizen HC, Ameling CB, Staatsen BAM, de Hollander AEM. The association between noise exposure and blood pressure and ischemic heart disease: a meta-analysis. *Environ Health Perspect.* 2002; 110:307–17. [PubMed: 11882483]
49. Tomei G, Fioravanti M, Cerratti D, et al. Occupational exposure to noise and the cardiovascular system: a meta-analysis. *Sci Total Environ.* 2010; 408:681–89. [PubMed: 19931119]

50. Davies H, van Kamp IV. Noise and cardiovascular disease: a review of the literature 2008–2011. *Noise Health*. 2012; 14:287–91. [PubMed: 23257579]
51. Huss A, Spoerri A, Egger M, Rösli M. for the Swiss National Cohort Study Group. Aircraft noise, air pollution, and mortality from myocardial infarction. *Epidemiology*. 2010; 21:829–36. [PubMed: 20881600]
52. Sørensen M, Hvidberg M, Andersen ZJ, et al. Road traffic noise and stroke: a prospective cohort study. *Eur Heart J*. 2011; 32:737–44. [PubMed: 21266374]
53. Gan WQ, Davies HW, Koehoorn M, Brauer M. Association of long-term exposure to community noise and traffic-related air pollution with coronary heart disease mortality. *Am J Epidemiol*. 2012; 175:898–906. [PubMed: 22491084]
54. Babisch W, Kamp I. Exposure-response relationship of the association between aircraft noise and the risk of hypertension. *Noise Health*. 2009; 11:161–68. [PubMed: 19602770]
55. Babisch W. Road traffic noise and cardiovascular risk. *Noise Health*. 2008; 10:27–33. [PubMed: 18270405]
56. Evans GW. Child development and the physical environment. *Annu Rev Psychol*. 2006; 57:423–51. [PubMed: 16318602]
57. Evans, G.; Hygge, S. Noise and performance in adults and children. In: Luxon, L.; Prasher, D., editors. *Noise and its effects*. London: Whurr Publishers; 2007.
58. Hygge S, Evans GW, Bullinger M. A prospective study of some effects of aircraft noise on cognitive performance in schoolchildren. *Psychol Sci*. 2002; 13:469–74. [PubMed: 12219816]
59. Bronzaft AL. The effect of a noise abatement program on reading ability. *J Environ Psychol*. 1981; 1:215–22.
60. Lercher P, Evans GW, Meis M. Ambient noise and cognitive processes among primary schoolchildren. *Environ Behav*. 2003; 35:725–35.
61. Stansfeld SA, Berglund B, Clark C, et al. for the RANCH study team. Aircraft and road traffic noise and children's cognition and health: a cross-national study. *Lancet*. 2005; 365:1942–49. [PubMed: 15936421]
62. Clark C, Martin R, van Kempen E, et al. Exposure-effect relations between aircraft and road traffic noise exposure at school and reading comprehension: the RANCH project. *Am J Epidemiol*. 2006; 163:27–37. [PubMed: 16306314]
63. Berglund, B.; Lindvall, T.; Schwela, DH. *Guidelines for Community Noise*. World Health Organization (WHO); Geneva: 1999. <http://whqlibdoc.who.int/hq/1999/a68672.pdf> [accessed July 11, 2013]
64. Dang-Vu TT, McKinney SM, Buxton OM, Solet JM, Ellenbogen JM. Spontaneous brain rhythms predict sleep stability in the face of noise. *Curr Biol*. 2010; 20:R626–27. [PubMed: 20692606]
65. Basner M, Samel A, Isermann U. Aircraft noise effects on sleep: application of the results of a large polysomnographic field study. *J Acoust Soc Am*. 2006; 119:2772–84. [PubMed: 16708935]
66. Basner M, Müller U, Griefahn B. Practical guidance for risk assessment of traffic noise effects on sleep. *Appl Acoust*. 2010; 71:518–22.
67. Brink M, Basner M, Schierz C, et al. Determining physiological reaction probabilities to noise events during sleep. *Somnologie*. 2009; 13:236–43.
68. Cassel W, Ploch T, Griefahn B, et al. Disturbed sleep in obstructive sleep apnea expressed in a single index of sleep disturbance (SDI). *Somnologie*. 2008; 12:158–64.
69. Basner M. Nocturnal aircraft noise increases objectively assessed daytime sleepiness. *Somnologie*. 2008; 12:110–17.
70. Elmenhorst EM, Elmenhorst D, Wenzel J, et al. Effects of nocturnal aircraft noise on cognitive performance in the following morning: dose-response relationships in laboratory and field. *Int Arch Occup Environ Health*. 2010; 83:743–51. [PubMed: 20143082]
71. Jarup L, Babisch W, Houthuijs D, et al. the HYENA study team. Hypertension and exposure to noise near airports: the HYENA study. *Environ Health Perspect*. 2008; 116:329–33. [PubMed: 18335099]

72. Night noise guidelines for Europe. World Health Organisation (WHO); Copenhagen, Denmark: 2009. http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf [accessed July 11, 2013]
73. Busch-Vishniac IJ, West JE, Barnhill C, Hunter T, Orellana D, Chivukula R. Noise levels in Johns Hopkins Hospital. *J Acoust Soc Am*. 2005; 118:3629–45. [PubMed: 16419808]
74. Hagerman I, Rasmanis G, Blomkvist V, Ulrich R, Eriksen CA, Theorell T. Influence of intensive coronary care acoustics on the quality of care and physiological state of patients. *Int J Cardiol*. 2005; 98:267–70. [PubMed: 15686777]
75. Parthasarathy S, Tobin MJ. Sleep in the intensive care unit. *Intensive Care Med*. 2004; 30:197–206. [PubMed: 14564378]
76. Xie H, Kang J, Mills GH. Clinical review: The impact of noise on patients' sleep and the effectiveness of noise reduction strategies in intensive care units. *Crit Care*. 2009; 13:208. [PubMed: 19344486]
77. Buxton OM, Ellenbogen JM, Wang W, et al. Sleep disruption due to hospital noises: a prospective evaluation. *Ann Intern Med*. 2012; 157:170–79. [PubMed: 22868834]
78. Messingher G, Ryherd EE, Ackerman J. Hospital noise and staff performance. *J Acoust Soc Am*. 2012; 132:2031.
79. Ryherd EE, Waye KP, Ljungkvist L. Characterizing noise and perceived work environment in a neurological intensive care unit. *J Acoust Soc Am*. 2008; 123:747–56. [PubMed: 18247879]
80. Blomkvist V, Eriksen CA, Theorell T, Ulrich R, Rasmanis G. Acoustics and psychosocial environment in intensive coronary care. *Occup Environ Med*. 2005; 62:e1. [PubMed: 15723873]
81. Richardson A, Thompson A, Coghill E, Chambers I, Turnock C. Development and implementation of a noise reduction intervention programme: a pre- and postaudit of three hospital wards. *J Clin Nurs*. 2009; 18:3316–24. [PubMed: 19732242]

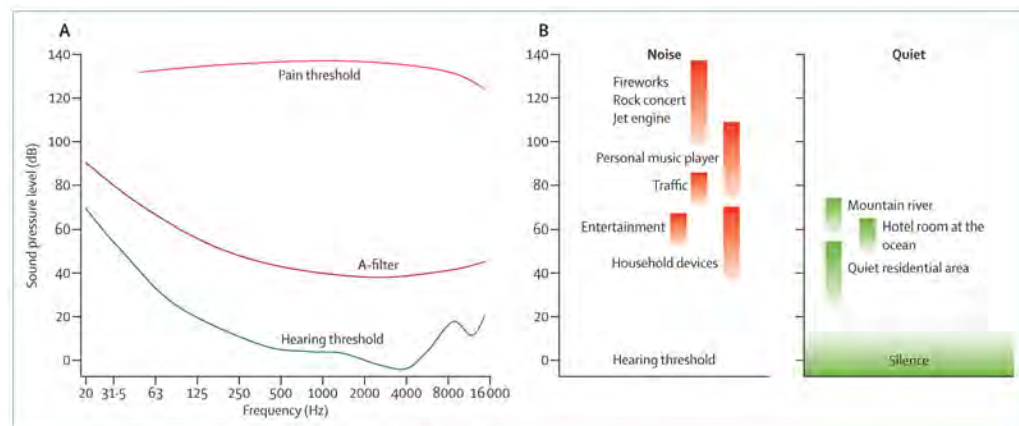


Figure 1. Sound pressure levels

(A) The sensitivity of the auditory system depends on sound frequency and sensitivity is highest between 2000 Hz and 5000 Hz (green line). The A-filter (dark red line) is a frequency-weighting of sound pressure levels that mimics the sensitivity of the auditory system (eg, low-frequency sounds contribute little to the A-weighted dB level). (B) A-weighted sound pressure levels for several environmental sounds, emphasising that whether or not a sound is perceived as noise depends largely on the context and the individual, and is only partly determined by its sound pressure levels. For example, spectators attending a rock concert might not perceive the music as noise, whereas residents in the vicinity of the venue might call it noise, even though sound pressure levels are much lower there than for inside.

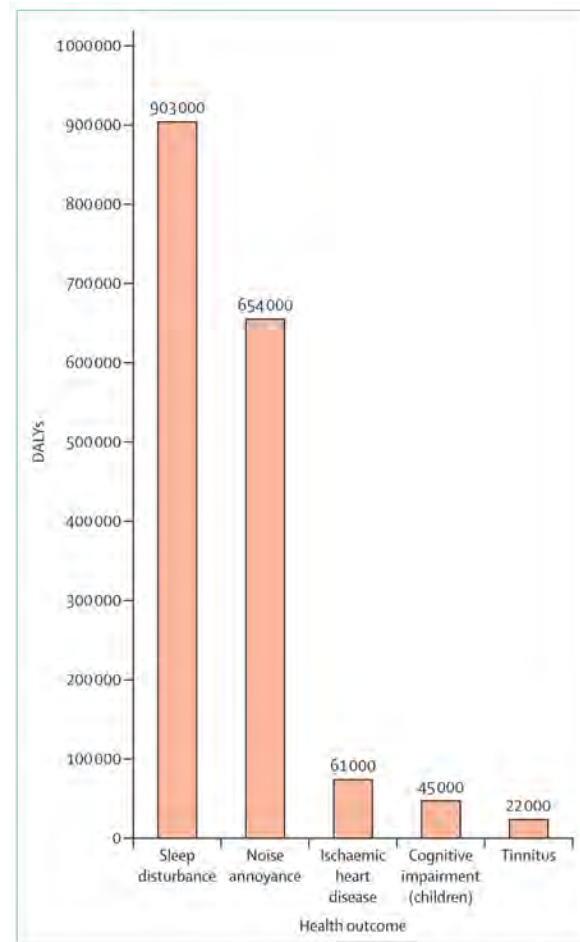


Figure 2. DALYs attributed to environmental noise exposure in Europe

According to WHO,¹⁴ more than 1 million healthy life years (DALYs) are lost annually because of environmental noise exposure in European A-member states alone. Most of these DALYs can be attributed to noise-induced sleep disturbance and annoyance. DALYs=Disability-adjusted life years.

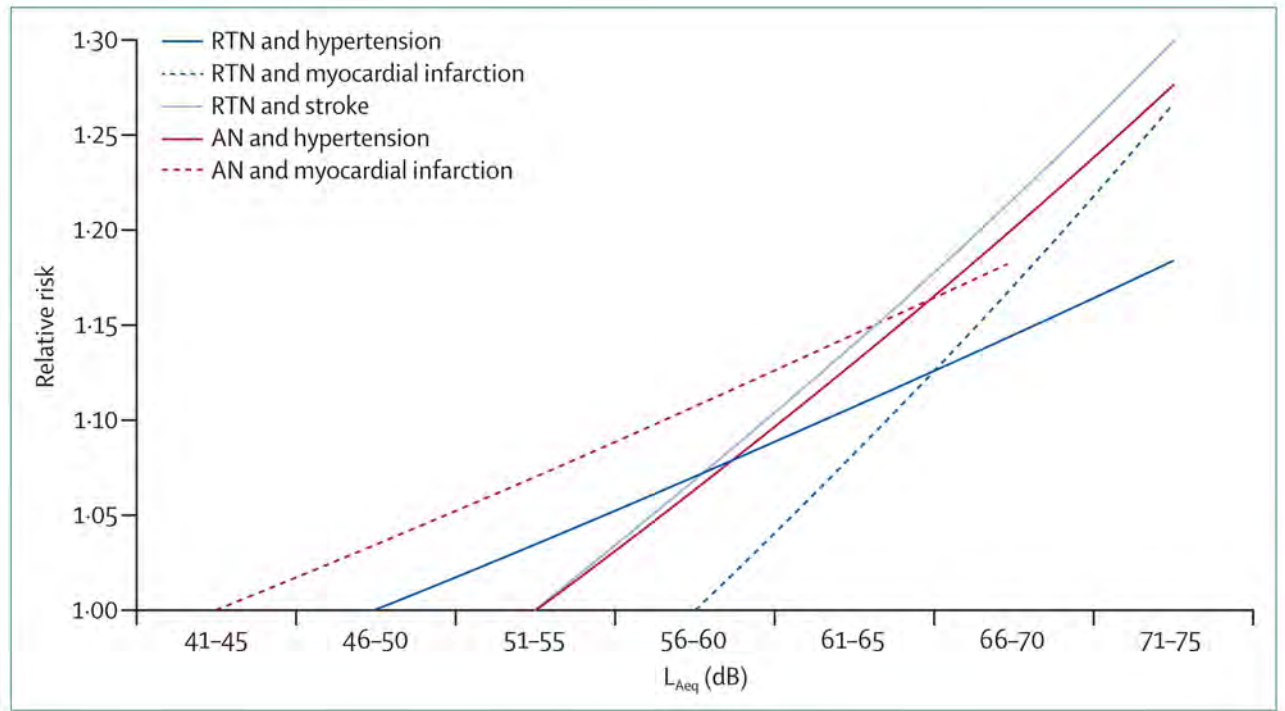
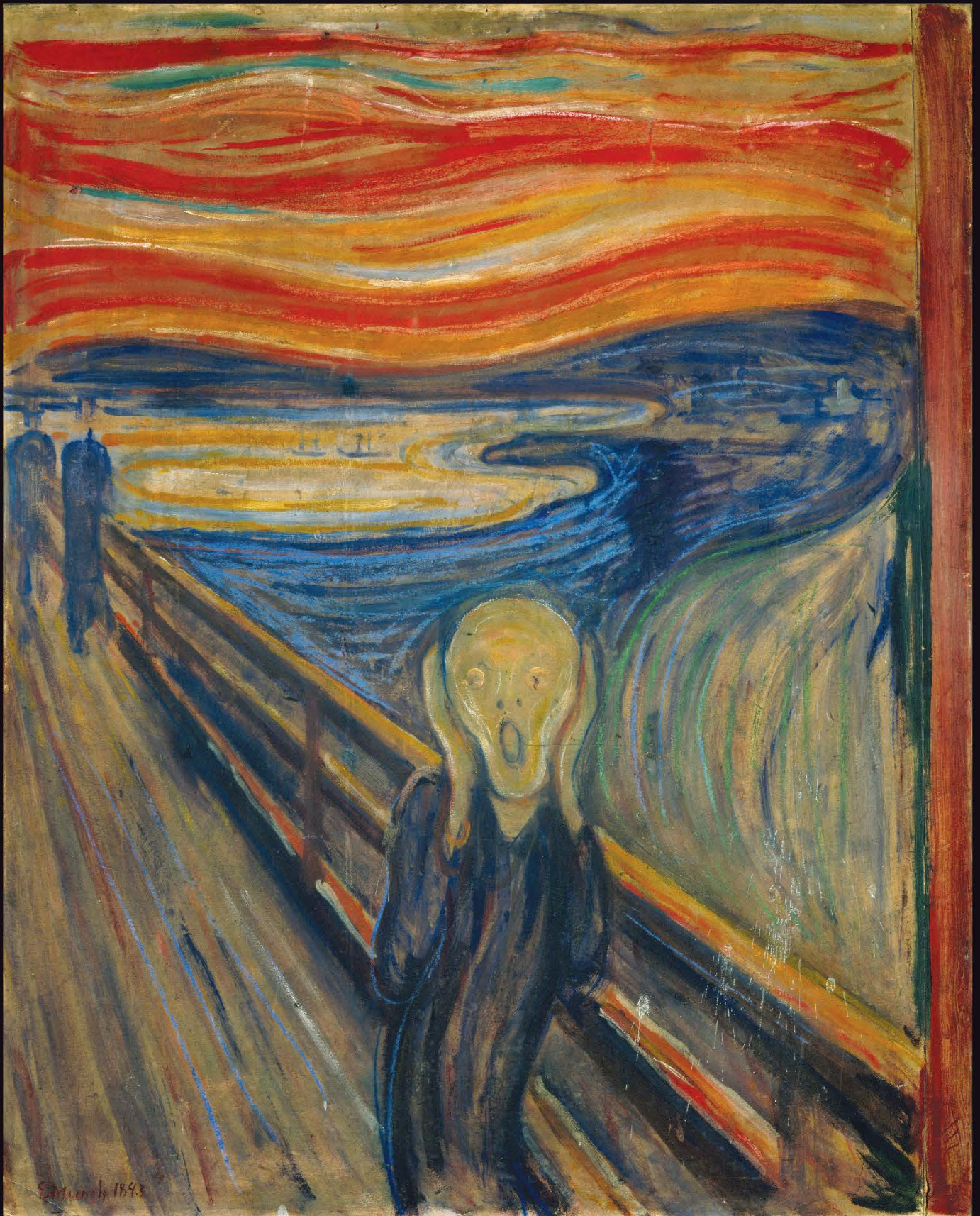


Figure 3. Exposure-response curves of road and aircraft noise and cardiovascular endpoints RTN and hypertension (24 studies, noise indicator L_{Aeq16h}); RTN and myocardial infarction (five studies, noise indicator L_{Aeq16h}); RTN and stroke (one study, noise indicator L_{DEN}); AN and hypertension (five studies, noise indicator L_{DN}); and AN and MI (one study, noise indicator L_{DN}). RTN=road traffic noise. AN=aircraft noise.

TAB BB



© 2004 The Munch Museum/The Munch-Ellingen Group/Artists Rights Society (ARS), NY, Erich Lessing/Art Resource, NY

Decibel Hell

It's not difficult for a person to encounter sound at levels that can cause adverse health effects. During a single day, people living in a typical urban environment can experience a wide range of sounds in many locations, including shopping malls, schools, the workplace, recreational centers, and the home. Even once-quiet locales have become polluted with noise. In fact, it's difficult today to escape sound completely. In its 1999 *Guidelines for Community Noise*, the World Health Organization (WHO) declared, "Worldwide, noise-induced hearing impairment is the most prevalent irreversible occupational hazard, and it is estimated that 120 million people worldwide have disabling hearing difficulties." Growing evidence also points to many other health effects of too much volume.

The growing noise pollution problem has many different causes. Booming population

growth and the loss of rural land to urban sprawl both play a role. Other causes include the lack of adequate anti-noise regulations in many parts of the world; the electronic nature of our age, which encourages many noisy gadgets; the rising number of vehicles on the roads; and busier airports.

The U.S. Environmental Protection Agency (EPA) has long identified transportation—passenger vehicles, trains, buses, motorcycles, medium and heavy trucks, and aircraft—as one of the most pervasive outdoor noise sources, estimating in its 1981 *Noise Effects Handbook* that more

than 100 million people in the United States are exposed to noise sources from traffic near their homes.

Some experts define noise simply as "unwanted sound," but what can be unwanted for one person can be pleasant or even essential sound to another—consider boom boxes, car stereos,

The Effects of Living in a Noisy World

drag races, and lawn mowers in this context. Sound intensity is measured in decibels (dB); the unit A-weighted dB (dBA) is used to indicate how humans hear a given sound. Zero dBA is considered the point at which a person begins to hear sound. A soft whisper at 3 feet equals 30 dBA, a busy freeway at 50 feet is around 80 dBA, and a chain saw can reach 110 dBA or more at operating distance. Brief exposure to sound levels exceeding 120 dBA without hearing protection may even cause physical pain.

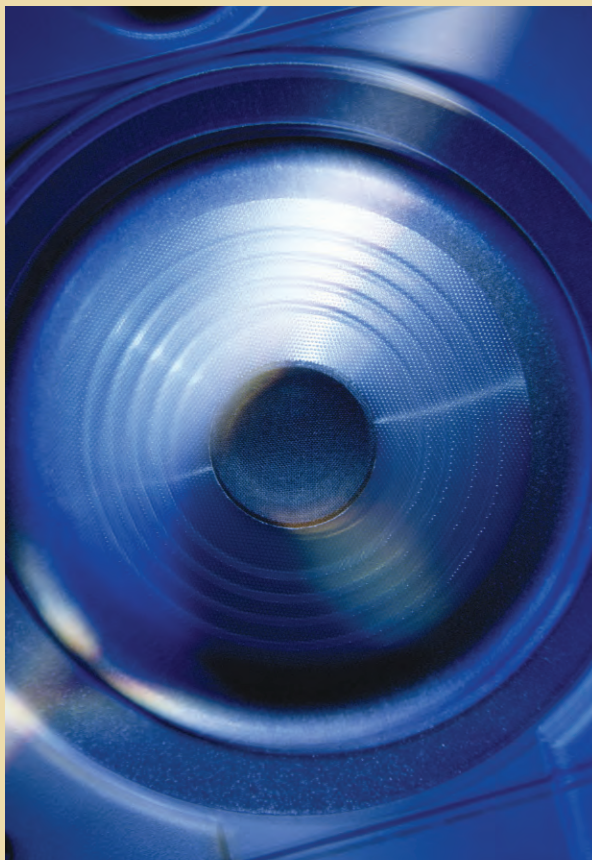
Mark Stephenson, a Cincinnati, Ohio-based senior research audiologist at the National Institute for Occupational Safety and Health (NIOSH), says his agency's definition of hazardous noise is sound that exceeds the time-weighted average of 85 dBA, meaning the average noise exposure measured over a typical eight-hour work day. Other measures and definitions are used for other purposes. For example, "sound exposure level" accounts for variations in sound from moment to moment, while "equivalent sound level" determines the value of a steady sound with the same dBA sound energy as that contained in a time-varying sound.

Growing Volume

In the United States, about 30 million workers are exposed to hazardous sound levels on the job, according to NIOSH. Industries having a high number of workers exposed to loud sounds include construction, agriculture, mining, manufacturing, utilities, transportation, and the military.

Noise in U.S. industry is an extremely difficult problem to monitor, acknowledges Craig Moulton, a senior industrial hygienist for the Occupational Safety and Health Administration (OSHA). "Still," he says, "OSHA does require that any employer with workers overexposed to noise provide protection for those employees against the harmful effects of noise. Additionally, employers must implement a continuing, effective hearing conservation program as outlined in OSHA's Noise Standard."

Meanwhile, there is no evidence to suggest things have gotten any quieter for residents since the EPA published its 1981 handbook. "For many people in the United States, noise has drastically affected the quality of their lives," says Arline L. Bronzaft, chair of the Noise Committee of the New York City Council of the Environment and a psychologist who has done pioneering research on the effects of noise on children's reading ability. "My daughter lives near La Guardia airport in New York City, and she can't open a window or enjoy her backyard in



On the street. Booming bass is quickly becoming the soundtrack of urban life.



On the increase. Our technological society encourages the propagation of noisy devices, and children are being exposed earlier than ever to an abundance of electronic noise.

the summer because of the airplane noise."

Indeed, the term *secondhand noise* is increasingly used to describe noise that is experienced by people who did not produce it. Anti-noise activists say its effect on people is similar to that of secondhand smoke. "Secondhand noise is really a civil rights issue," says Les Blomberg, executive director of the Noise Pollution Clearinghouse, an anti-noise advocacy group based in Montpelier, Vermont. "Like secondhand smoke, it's put into the environment without people's consent and then has effects on them that they don't have any control over."

Secondhand noise can also have a negative effect in the workplace. "Workers in the construction trades get exposure to noise not just from what they are doing but also from what is going on around them," says Rick Neitzel, director of communications for the National Hearing Conservation Association. "Electricians, for example, have a reputation as being a member of a quiet trade, but if they work all day next to a laborer who is using a jackhammer, it's going to have a harmful effect."

Even disregarding other people's noise, there are any number of household tools

and appliances that can produce harmful sound levels in the comfort of one's own home. According to the fact sheet "Noise in the Home" produced by the League for the Hard of Hearing, dishwashers, vacuum cleaners, and hair dryers can all reach or exceed 90 dBA.

Our modern industrialized society has spawned ubiquitous entertainment and sports industries with their boom boxes, "personal stereos" (Gap Kids now even offers a jacket with a built-in radio and speakers conveniently attached right in the hood), surround-sound movie theaters, loud TV commercials, and even louder commercials at sports stadiums crammed full of thousands of noisy fans. In drag racing, a growing international sport, a German team of audio engineers set an ear-splitting record of 177 dB—sound pressure level in 2002. Popular "boom cars" equipped with powerful stereo systems that are usually played with the volume and bass turned up abnormally high and the car windows rolled down can hit 140–150 dBA. Listening to music at a level of 150 dBA would be like standing next to a Boeing 747 airplane with its engines at full throttle, according to statistics provided by Noise Free America, an anti-noise advocacy group.

Even the countryside is not immune to the impact of noise pollution. According to the New York Center for Agricultural Medicine and Health in Cooperstown, a staggering 75% of farmworkers have some kind of hearing problem, largely the result of long-term exposure to loud equipment.

The United States is not the only country where noise pollution is affecting the quality of life. In Japan, for instance, noise pollution caused by public loudspeaker messages and other forms of city noise have forced many Tokyo citizens to wear earplugs as they go about their daily lives. In Europe, about 65% of the population is exposed to ambient sound at levels above 55 dBA, while about 17% is exposed to levels above 65 dBA, according to the European Environment Agency.

"The noisy problems associated with air travel are concentrated in communities around airports, whereas motorways or high-speed trains—traveling, for instance, from north to south Europe—have the potential to disturb thousands of people living along the route day after day," says Ken Hume, a principal lecturer in human physiology at the Manchester Metropolitan University in England.

Noise is indeed everywhere, and experts expect no decrease in noise levels, given the powerful impact of technology on modern

Counting Decibels

Device/Situation	dBA *
Grand Canyon at night, no birds, no wind	10
Quiet room	28–33
Computer	37–45
Floor fan	38–70
Refrigerator	40–43
Normal conversation	40
Forced-air heating system	42–52
Radio playing in background	45–50
Clothes washer	47–78
Dishwasher	54–85
Bathroom exhaust fan	54–55
Microwave oven	55–59
Normal conversation	55–65
Laser printer	58–65
Hair dryer	59–90
Window fan on "high" setting	60–66
Alarm clock	60–80
Vacuum cleaner	62–85
Push reel mower	63–72
Sewing machine	64–74
Telephone	66–75
Food disposal	67–93
Inside car with windows closed, traveling at 30 miles per hour	68–73
Handheld electronic game	68–76
Inside car with windows open, traveling at 30 miles per hour	72–76
Electric shaver	75
Air popcorn popper	78–85
Electric lawn edger	81
Electric can opener	81–83
Gasoline-powered push lawn mower	87–92
Average motorcycle	90
Air compressor	90–93
Weed trimmer	94–96
Leaf blower	95–105
Circular saw	100–104
Maximum output of stereo	100–120
Chain saw	110
Average snowmobile	120
Average fire crackers	140
Average rock concert	140

* Measurements are approximate and may vary by source.

Sources: National Institute on Deafness and Other Communication Disorders, Environmental Protection Agency, Noise Pollution Clearinghouse.

life. "In the past three decades, we have built noisier and noisier devices that are not subject to any regulations," Blomberg says. "Think about it. The car alarm is a seventies invention, as is the leaf blower. The

stereo sound systems we have in our cars are much louder than the sound system the Beatles used for their concerts in the sixties. All they had back then were three-hundred-amp speakers."



On the job. Occupational noise is pervasive throughout many industries and may cause serious damage despite regulations to protect workers' hearing.

Scary Sound Effects

Numerous scientific studies over the years have confirmed that exposure to certain levels of sound can damage hearing. Prolonged exposure can actually change the structure of the hair cells in the inner ear, resulting in hearing loss. It can also cause tinnitus, a ringing, roaring, buzzing, or clicking in the ears. The American Tinnitus Association estimates that 12 million Americans suffer from this condition, with at least 1 million experiencing it to the extent that it interferes with their daily activities.

NIOSH studies from the mid to late 1990s show that 90% of coal miners have hearing impairment by age 52—compared to 9% of the general population—and 70% of male metal/nonmetal miners will experience hearing impairment by age 60 (Stephenson notes that from adolescence onward, females tend to have better hearing than males). Neitzel says nearly half of all construction workers have some degree of hearing loss. “NIOSH research also reveals that by age twenty-five, the average carpenter’s hearing is equivalent to an otherwise healthy fifty-year-old male who hasn’t been exposed to noise,” he says.

“Noise has an insidious effect in that the more exposure a person has to noise, the more the hearing loss will continue to grow,” says Josara Wallber, disabilities services liaison

for the National Technical Institute for the Deaf in Rochester, New York. “Hearing loss is irreversible. Once hearing is lost, it’s lost forever.”

William Luxford, medical director of the House Ear Clinic of St. Vincent Medical Center in Los Angeles, points out one piece of good news: “It’s true that continuous noise exposure will lead to the continuation of hearing loss, but as soon as the exposure is stopped, the hearing loss stops. So a change in environment can improve a person’s hearing health.”

For many young people, changing their environment and their behavior would be a wise and healthy move. That’s because audiologists are fitting more and more of them with hearing aids, says Rachel Cruz, a research associate at the House Ear Clinic. She says audiologists are blaming this disturbing development on youth’s penchant for listening to loud music, especially with the use of headphones.

Research is catching up with this anecdotal evidence. In the July 2001 issue of *Pediatrics*, researchers from the Centers for Disease Control and Prevention reported that, based on audiometric testing of 5,249 children as part of the Third National Health and Nutrition Examination Survey, an estimated 12.5% of American children have noise-induced hearing threshold shifts—or dulled hearing—in one or both

ears. Most children with noise-induced hearing threshold shifts have only limited hearing damage, but continued exposure to excessive noise can lead to difficulties with high-frequency sound discrimination. The report listed stereos, music concerts, toys (such as toy telephones and certain rattles), lawn mowers, and fireworks as producing potentially harmful sounds.

For the baby boom generation, on the other hand, a change of environment may be too late. “Many baby boomers began losing their hearing when the amplification of popular music came into vogue in the nineteen sixties,” says Cruz. “We are starting to see that a lot of musicians and audio engineers who have been involved with popular music for a long time are having hearing problems.” Cruz is gathering data for a research study to examine how these professionals’ occupational sound exposures affect their hearing over a span of years.

Beyond the Ears

The effects of sound don’t stop with the ears. Nonauditory effects of noise exposure are those effects that don’t cause hearing loss but still can be measured, such as elevated blood pressure, loss of sleep, increased heart rate, cardiovascular constriction, labored breathing, and changes in brain chemistry. According to the WHO *Guidelines for Community Noise*, “these health effects, in turn, can lead to social handicap, reduced productivity, decreased performance in learning, absenteeism in the workplace and school, increased drug use, and accidents.”

The nonauditory effects of noise were noted as early as 1930 in a study published by E.L. Smith and D.L. Laird in volume 2 of the *Journal of the Acoustical Society of America*. The results showed that exposure to noise caused stomach contractions in healthy human beings. Reports on noise’s nonauditory effects published since that pioneering study have been both contradictory and controversial in some areas.

Data pertaining to whether noise can increase the risk of damage to the fetus is a case in point. A study published by L.D. Edmonds, P.M. Layde, and J.D. Erickson in the July–August 1979 issue of the *Archives of Environmental Health* found no significant data suggesting an effect of noise on fetal development in pregnant women who lived near airports. But in the October 1997 issue of *Pediatrics*, the Committee on Environmental Health of the American Academy of Pediatrics published a policy statement based on a review of research on the potential health effects of noise on the fetus and the newborn. The committee

concluded that excessive noise exposure *in utero* may result in high-frequency hearing loss in newborns and further that excessive sound levels in neonatal intensive care units may disrupt the natural growth and development of premature infants. It recommended that noise-induced health effects on fetuses and newborns are clinical and public health concerns that merit further study.

Studies have revealed that as children grow they are exposed to sounds that can threaten their health and cause learning problems. For instance, in the September 1997 issue of *Environment and Behavior*, Cornell University environmental psychologists Gary Evans and Lorraine Maxwell reported that the constant roar of jet aircraft could cause higher blood pressure, boosted stress levels, and other effects with potential life-long ramifications among children living in areas under the flight paths of airport.

Other human and animal studies also have linked noise exposure to chronic changes in blood pressure and heart rate. For example, in the July–August 2002 issue of the *Archives of Environmental Health*, a team of government and university researchers concluded that exposure to sound “acts as a stressor—activating physiological mechanisms that over time can produce adverse health effects. Although all the effects and mechanisms are not elucidated, noise may elevate systolic blood pressure, diastolic blood pressure, and heart rate, thus producing both acute and chronic health effects.”

Noise has also been shown to affect learning ability. In 1975 Bronzaft collaborated on a study of children in a school near an elevated train track that showed how exposure to noise can affect children’s reading ability. Half of the students in the study were in classrooms facing the train track and the other half were in classrooms in the school’s quieter back section. The findings, published in the December 1975 issue of *Environment and Behavior*, were that students on the quieter side performed better on reading tests, and by sixth grade they were a full grade point ahead of the students in the noisier classrooms.

Bronzaft and the school principal persuaded the school board to have acoustical tile installed in the classrooms adjacent to the tracks. The Transit Authority also treated the tracks near the school to make them less noisy. A follow-up study published in the September 1981 issue of the *Journal of Environmental Psychology* found that children’s reading scores improved after these interventions were put in place. “After we

did the study, more than twenty-five other studies were done examining the effect of noise on children’s learning ability,” Bronzaft says. “They have all found the same thing to be true: noise can affect children’s learning.”

The EPA reported in the *Noise Effects Handbook* that surveys taken in communities significantly affected by noise indicated that interruption of sleep was the underlying cause of many people’s complaints. Research has shown that unwanted sound is most annoying at the times when people expect to rest or sleep, that it can interrupt or delay sleep, and that it can have subtle effects on sleep, such as causing shifts from

deeper to lighter sleep stages. “The research is pretty solid that noise can prevent people from getting a good night’s sleep,” Hume says. “I believe that sleep deprivation can have negative health effects when it becomes a chronic problem.”

Fighting for Quiet

Worldwide, airports have become a flash point for community frustration over noise pollution. In September 2002, officials at the Frankfurt am Main Airport in Germany received 56,330 noise-related complaints, a 30% increase over the same month in 2001. The same year, residents living near a rural airport outside London, England, were



On the go. Transportation sound is perhaps the largest contributor to urban noise pollution.





On the way up. Problems from airplane and airport noise are increasing as more and more flights take off over residential areas.

submitting 100 petitions daily, objecting to proposals for three new runways at the site.

In March 2003, representatives from eight neighborhoods in Portland, Oregon, showed up for a city council hearing convened to discuss dozens of expansion projects for Portland International Airport. The airport was already a busy one: in 2002 it handled 12.2 million passengers and about 29,000 containers of air cargo. "The impacts are tremendous on the neighborhoods under the flight paths," testified one neighborhood representative, Jean Ridings. "People move in and move [right back] out. It's becoming a disaster." In response, the airport has initiated a multiyear, multimillion-dollar effort to study the sound impact of the airport, which locals hope will lead to a plan to reduce airport noise.

Noise Free America is seeking to file a class-action lawsuit against the makers of boom car equipment. Ted Rueter, Noise Free America's director and an assistant professor of political science at DePauw University in Greencastle, Indiana, says one group member has written a legal brief on the topic and has approached several

public-interest law firms seeking representation, with no takers so far. Rueter says Noise Free America will continue to pursue the suit.

A lot of money is being made from disturbing the peace, charges Mark Huber, communications director for Noise Free America. "By using paid lobbyists in Washington, D.C., and in state legislatures, the automobile and entertainment industries are quietly removing obstacles protecting the public against noise," Huber says. "Try to get a noise control law passed through a state legislature and see what happens. We tried to get a boom car law enacted in the Virginia General Legislature, but right here in Richmond there are at least fifty car clubs, all of which are politically active. So our legislation disappeared."

Stephen McDonald, vice president of government affairs for the Washington, D.C.-based Specialty Equipment Market Association (SEMA), denies that any powerful lobby exists and is working against the best interests of society. SEMA represents manufacturers, distributors, retailers, and installers of specialty automotive equipment,

including boom car equipment. "Our prime focus is representing the interests of businesses that sell exhaust systems," McDonald says. "But that doesn't mean we want the products to increase noise to a level where it becomes objectionable. We do need to strike a balance, though, between what is acceptable for a neighborhood and what's fair to people who want to customize their cars."

Anti-noise activists say that Europe and several countries in Asia are more advanced than the United States in terms of combating noise. "Population pressure has prompted Europe to move more quickly on the noise issue than the United States has," Hume says. In the European Union, countries with cities of at least 250,000 people are creating noise maps of those cities to help leaders determine noise pollution policies. Paris has already prepared its first noise maps. The map data, which must be finished by 2007, will be fed into computer models that will help test the sound impact of street designs or new buildings before construction begins.

In the United States, the Noise Control Act of 1972 empowered the EPA to determine noise limits to protect the public health and welfare, and to establish a noise control office. Congress did establish the Office of Noise Abatement and Control (ONAC), as well as federal standards for business, industries, and communities, and it did begin researching the effects of sound exposures. In 1982, however, the Reagan administration defunded the office. "We are no longer doing research on noise," says Kenneth Feith, an EPA senior scientist and policy advisor. "We just don't have the money or staff to do it."

Activists believe that closing the ONAC has had a tremendous negative effect at the state and local level. "The U.S. has long since given up its lead in regulating noise, and because of that there has been no consistency in implementing local noise regulations," Huber says. The Noise Control Act, though still on the books, is essentially toothless.

In the mid-1990s, people in the borough of Queens, New York, who lived under the flight paths of La Guardia Airport, took their concerns about noise to Representative Nina Lowey (D-NY). "I could see that noise is a serious public health issue, and so I decided to do something about it," Lowey says. In 1997 the congresswoman introduced legislation that's become known as the Quiet Communities Act (HR 536), which provided for the refunding of the ONAC and for \$21 million to be spent annually on noise reduction. Among other measures, the money would be used to carry out a national noise assessment program to

identify trends in noise exposure and response, develop and disseminate information and public education materials on the health effects of noise, and establish regional technical assistance centers, which would use the resources of universities and private organizations to assist state and local noise control programs.

"More and more communities are being affected by airports, trains, and railways," Lowey says. "We need a national office to coordinate policy. That's common sense to me. The federal government has to play a larger role on the noise issue. Otherwise, we will continue to lag behind other parts of the world in combating noise." While Lowey remains optimistic that the legislation will eventually pass, other sources doubt that it will happen, noting that the proposed legislation has been introduced and rejected several times.

Activists in other countries say they too want the United States to play a more

leading role on the noise issue. "Re-establishing the ONAC would be a huge move in the right direction," says Hans Schmid, the Vancouver, Canada-based president of the Right to Quiet Society. "That will show that the United States is serious about the noise issue. If the United States leads, other countries, especially Canada, will follow."

But as in other areas of environmental health, merely having a more powerful government agency in place that can set more regulations is not the ultimate answer, according to other experts. Regulations provide an important foundation, Stephenson says, but better education of workers, consumers, businesses, and citizens is critical. "We've found that in some factories as many as one-third of the workers who have significant hearing loss don't wear hearing protectors, even though the factory has a comprehensive hearing conservation program in place," he says.

Bronzaft stresses that governments worldwide need to increase funding for noise research and do a better job coordinating their noise pollution efforts so they can establish health and environmental policies based on solid scientific research. "Governments have a responsibility to protect their citizens by curbing noise pollution," she says.

Feith agrees. "The EPA had a successful educational program in the nineteen seventies in which we went to schools and educated students about noise," he says. "When students took the message home, they helped increase the sensitivity to the noise issue. We need more programs like that to educate the public about noise."

In the meantime, some facilities are doing what they can to help themselves to a quieter environment. Although peace and quiet are essential prerequisites for a healing environment, a Mayo Clinic study published in the February 2004 issue of the *American Journal of Nursing* showed that peak noise levels during the clinic's morning shift change rivaled the excruciating sound of a jackhammer. The study further showed that a few simple changes—for example, holding staff reports at shift change in an enclosed room (rather than at the nurses' station) and replacing roll-type paper towel dispensers with quieter models—reduced peak noise levels at shift change by 80%.

Similarly, the din of overhead pagers, which can reach 80 dBA, inspired the developers of the Woodwinds Health Campus in Woodbury, Minnesota, to build the facility with a staff location sensor and badge system, among other sound-friendly features. Staff can be located in just about any area of the Woodwinds campus without being paged. "We have developed an innovative approach to reducing noise in our hospital while fostering a healing environment," says Cindy Bultena, executive lead of healing and clinical coordination for Woodwinds. "Our change sounds simple enough, but it's a very radical one for hospitals."

By delivering their patients and staff from decibel hell, facilities like Woodwinds and the Mayo Clinic have scored one small victory in the ongoing battle against noise pollution. Their initiative, moreover, shows that given the pervasiveness and harmful effects of noise, governments, communities, and organizations worldwide will need to be creative and aggressive in addressing what will certainly continue to be one of the 21st century's most important environmental health issues.

Ron Chepesiuk



On the mend? Hospitals can be some of the noisiest public locations, but some health care facilities are actively fighting noise in the interest of better patient care.

Photodisc

TAB CC

NOISE REGULATION OF THE SHALE OIL & GAS EXTRACTION AND PRODUCTION INDUSTRY

6th Law of Shale Plays Conference

Institute for Energy Law, Center for American & International Law

Energy & Mineral Law Foundation

Pittsburgh, PA - September 10-11, 2015

R. Timothy Weston

Tad Macfarlan

K&L Gates LLP

17 North Second Street, 18th Floor

Harrisburg, PA 17101

(717) 231-4500

tim.weston@klgates.com

tad.macfarlan@klgates.com

Table of Contents

A.	Introduction.....	1
B.	What is “Noise”? – Definition & Measurement	1
C.	The Oil & Gas Industry’s Noise Issues	4
D.	The Side-Track Federal Regulation of Noise	5
E.	State, Provincial and Local Regulation of Noise from Oil and gas operations	5
	1. Common Law Doctrines Applicable to Noise	6
	2. Pennsylvania	10
	3. Ohio.....	13
	4. West Virginia	13
	5. Texas	15
	6. Colorado.....	17
	7. Alberta, Canada.....	19
F.	Conclusion	22

A. INTRODUCTION

NOISE, n. A stench in the ear. Undomesticated music. The chief product and authenticating sign of civilization.¹

Ambrose Bierce's amusing definition conveys an apt observation concerning the challenges facing the shale oil and gas sector in tackling the issue of "noise." Since the dawn of the industrial revolution, if not long before, one hallmark of civilization has been the generation, propagation, receipt and reaction to "noise"—most commonly defined as "unwanted sound." Wherever humans come together and engage in activities of life and commerce, sound is generated. At some point along the spectrum of such sound – from the outdoor coffee house conversation to the din of late night patrons leaving the pub, from the barking dog to the construction worker's hammer, from the drone of lawnmowers on a summer evening to the cacophony of a busy airport – such sound becomes unwanted, annoying, disturbing, distracting, to the point of becoming a "nuisance." Beyond mere irritation, as documented in the U.S. Environmental Protection Agency's ("EPA") seminal "Levels Document,"² sound levels in the environment may reach the point of becoming a public health and welfare concern. Noise can cause hearing loss; interfere with human activities at home and work; annoy, awaken, anger and frustrate people; disrupt communications and individual thoughts; and become a biological stressor.³

To be sure, the oil and gas industry is not the first, or even the "worst," contributor to noise within the environment. But with the development of unconventional well drilling technologies, involving longer and more intensive drilling activities, more intensive truck traffic serving well pads, and the spread of gathering, conditioning and compressor facilities across areas heretofore not impacted by oil and gas activities, increased focus has been placed by the public and regulators alike on noise associated with shale plays. This paper seeks to provide a context to, and then survey, some of the developing regulatory approaches to shale play noise management.

B. WHAT IS "NOISE"? – DEFINITION & MEASUREMENT

The sound humans hear is the result of a source inducing vibration in the air or other media, with the vibrations producing alternating bands of dense and sparse particles of air,

¹ Ambrose Bierce, in *DEVIL'S DICTIONARY* (1911).

² EPA, Office of Noise Abatement & Control, Information on Levels of Environmental Noise Requisite to Protection Public Health and Welfare with an Adequate Margin of Safety, EPA/ONAC 550/9-74-004 (March 1974) ("EPA Levels Document"); *see also* EPA, Protective Noise Levels, Condensed Version of EPA Levels Document, EPA 550/9-79-100 (1979) ("EPA Condensed Levels Document").

³ EPA Condensed Levels Document at 1.

spreading outward in much the same way as ripples in water. Sound pressure waves radiate in all directions of the source, and may be scattered, reflected, sometimes concentrated or deflected, over the propagation pathways toward human and animal receptors. These pressure fluctuations are in turn converted into auditory sensations by the human ear, in turn triggering various types and degrees of reaction.

Sound is generally described in terms of three variables: (1) amplitude (perceived loudness), (2) frequency (pitch), and (3) time pattern.

Sound pressure is the amplitude or measure of difference between atmospheric pressure with and without the presence of a particular sound. The basic measure of sound pressure or amplitude is the decibel (“dB”). The decibel scale is logarithmic, not linear. Thus, a sound of 30 dB involves sound pressure waves 10 times that of 20 dB. Sharply painful sound is 10 million times greater than the source pressure that is merely audible. Multiple sources of sound can lead to higher cumulative sound levels, but two separate sounds are not directly (arithmetically) additive. Thus, a sound of 70 dB added to another source of 70 dB will result in a cumulative sound of 73 dB.

The frequency (pitch) of a sound is measured based on the number of waves per second (cycles per second) of the sound. The measurement metric is referred to as Hertz (“Hz”). A frequency of 100 Hz signifies a sound with 100 cycles per second. Most humans can hear frequency from about 16 to 20,000 Hz. As a reference, the hum of an electric current is 60 Hz. Most sounds consist of a complex mixture of frequency. On the other hand, humans are more sensitive to and find more annoying sounds involving “pure” frequency – e.g., an incessant hum.

The third variable, time pattern of sound, considers the continuity, duration, fluctuation, impulsiveness, intermittency of sound. Compared to relatively constant and even sounds, impulsive noises (the hammer blow or dropped pipe) are generally more irritating to receiving humans, snatching attention, disrupting thought, interrupting sleep.

Considering these three variables, trying to measure and describe environmental noise is not easy. Back in the 1970’s, EPA developed a system of four “sound descriptors” to summarize how people hear sound and determine the impact of noise on public health and welfare. The four descriptors were: (1) A-weighted Sound Level; (2) A-weighted sound Exposure Level; (3) Equivalent Sound Level; and (4) Day-Night Sound Level. As described in the EPA Levels Document, these four descriptors are related but each is more useful for particular types of measurements.

Most literature and noise regulatory provisions refer to A-weighted Sound Level, a measurement that attempts to reflect the relative sensitivity of the human ear to sounds of various frequencies, and applies “weights” to the sound levels of different frequencies along the spectrum to come up with one number that describes the overall relative sound level. Meters have been developed that contain the A-weighting network, allowing measurements to be taken and reported in decibels A-scale (“dBA”). Such dBA levels may be alternatively measured and

expressed on an instant peak, maximum level, or steady-state level. Generally, the A-weighted Sound Level has been adopted for most regulatory efforts because it is convenient, accurate for most purposes, and used extensively across the world.⁴

To set a benchmark for some of the discussion to follow, Figure 1 provides the relative A-weighted decibel values of some typical environmental noises.

Figure 1. Comparison of Approximate Sound Pressure Levels

<i>Environmental Sound Levels</i>	<i>dBA</i>	<i>Sound Levels at a Given Distance (Meters)</i>
Threshold of Pain	135	
	130	
	125	
	120	Jet Airplane Takeoff (500 m)
	115	
Typical Rock Concert	110	
	105	
On Platform by Passing Subway Train	100	
	95	Jackhammer (15 m)
	90	Compressor (8 m)
	85	Heavy Truck (15 m)
On Sidewalk by Typical Highway	80	Average well construction site (8 m)
	75	
	70	Vacuum Cleaner (3 m) / Tank Truck (152 m)
	65	Typewriter (1 m) / Avg. Well Construction Site (152 m)
Avg. Urban Area Background/Busy Office	60	Drilling pump (152 m)
	55	Large Transformer (15 m)
Urban Residence	50	Conversation (1 m)
Small Town Residence	45	
	40	

⁴ EPA's more tailored Sound Exposure Level, Equivalent Sound Level, and Day-Night Sound Level measures provide alternative methods for describing sound for different purposes. The Sound Exposure Level provides a summation of the energy of the momentary magnitudes of sound associated with an event, such as an airplane, train or truck. The Equivalent Sound Level provides a measure of the average environmental noise levels to which people are exposed, considering both the volume and duration of sound levels over some time period. The Day-Night Sound Level provides a means to characterize sound levels in residential areas throughout the day and night, and adds 10 dB to nighttime sounds (10 pm to 7 am) as a surrogate for the relatively increased irritation of residential recipients to night sounds. It may be noted that similar measures in other jurisdictions apply different weightings to nighttime sounds, ranging from 5–10 dBA. Compare Alberta Energy Regulator Directive 038: Noise Control (Feb. 16, 2007) at 8 (10 dBA adjustment) with Colorado Oil and Gas Conservation Commission Rule 802.b. (5 dBA adjustment).

<i>Environmental Sound Levels</i>	<i>dBA</i>	<i>Sound Levels at a Given Distance (Meters)</i>
Rural Area at Night	35	Soft Whisper (2 m)
	30	
Isolated Broadcast Studio	25	Rustling of Leaves (20 m)
	20	
Audiometric (hearing testing) Booth	15	
	10	
Threshold of Hearing	5	
	0	

C. THE OIL & GAS INDUSTRY’S NOISE ISSUES

Noise from shale play development and operations is derived from multiple sources: truck traffic, drilling and completion operations, pumps, compressors, generators, relief valves, etc. The challenge is that most shale play activities occur in relatively rural settings, where ambient noise levels are low and the nature and amplitude of noise levels generated in exploration and production (“E&P”) activities will be most noticeable to neighbors, particularly residences.

Various measurements and estimates have been made as to the sound levels produced by typical E&P operations. Some reported values (some of which are dated and may not be reliable) are reflected in the following table.

<i>Source</i>	<i>La Plata County, CO Study</i>	<i>BLM Draft EIS⁵</i>
Compressor	50 dBA (375 feet from property boundary)	89 dBA (50 feet from source) ⁶
Pumping units	50 dBA (325 feet from well pad)	82 dBA (50 feet from source)
Fuel and water trucks	68 dBA (500 feet from source)	
Crane for hoisting rigs	68 dBA (500 feet from source)	
Pump used during drilling	62 dBA (500 feet from source)	
Average well construction site	65 dBA (500 feet from source)	83 dBA (50 feet from source)
Produced water injection		71 dBA (50 feet from source)

⁵ Bureau of Land Management, *Draft RMPA/EIS for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties* (Oct. 2000)

⁶ As a note, sound attenuates in accordance with the inverse square law. See http://www.engineeringtoolbox.com/outdoor-propagation-sound-d_64.html. Thus, estimates of sound attenuation at distances greater than 50 feet can be approximated by applying a reduction of 6 dBA for each doubling of distance. Thus, 89 dBA at 50 feet would equate to 83 dBA at 100 feet, 77 dBA at 200 feet, and 71 dBA at 400 feet.

D. THE SIDE-TRACKED FEDERAL REGULATION OF NOISE

The Federal Government's foray into the field of noise regulation started out in earnest and eventually fell apart.

The Noise Control Act of 1972⁷ and the Quiet Communities Act of 1978⁸ sought to establish programs requiring the federal government to set and enforce uniform noise control standards for aircraft and airports, interstate motor carriers and railroads, workplace activities, medium and heavy-duty trucks, motorcycles and mopeds, portable air compressors, and federally assisted housing projects located in noise exposed areas. The Noise Control Act also required federal agencies to comply with all federal, state, and local noise control laws and regulations.

EPA's one time Office of Noise Abatement and Control ("ONAC") set out to implement these mandates, making substantial strides in the field of aircraft and airport noise control, noise labeling of various equipment, and certain other measures. Under this authority, EPA set noise control standards for certain construction equipment air compressors at 76 dBA.⁹ The standards for trucks over 10,000 pounds only apply to those manufactured after 1978 and range from 80 to 83 dBA depending on the model year.¹⁰

However, in 1981, the Reagan Administration concluded at the executive level that noise issues were best handled at the state or local government level. As a result, EPA shifted noise control policy to transfer the primary responsibility for regulating noise to state and local governments. ONAC's funding was phased out in 1992. The Noise Control Act of 1972 and the Quiet Communities Act of 1978, however, have never been rescinded by Congress and remain in effect today, although essentially unfunded.

E. STATE, PROVINCIAL AND LOCAL REGULATION OF NOISE FROM OIL AND GAS OPERATIONS

In the absence of a comprehensive federal regulatory regime, state and local governments have assumed primary responsibility for regulating noise in the United States.

Noise control is most often addressed via a combination of common law nuisance law and/or local codes and ordinances, which vary significantly in form from locality to locality. Historically, common law doctrines (primarily based in private and public nuisance) provided the vehicle by which neighbors and communities sought redress against noises deemed to be

⁷ P.L. 92-574, 86 Stat. 1234, Oct. 27, 1972, *as amended*, 42 U.S.C. §§ 4901–4918.

⁸ P.L. 95-609, 92 Stat. 3079, Nov. 8, 1978 (amending the Noise Control Act of 1972 and other federal statutes).

⁹ 40 C.F.R. Part 204.

¹⁰ *Id.* Part 205, Subpart B.

excessive or damaging. Common law approaches have been supplemented, and in some cases supplanted by, statutes, codes and ordinances addressing noise issues in various ways.

Municipal zoning codes indirectly control noise by establishing setbacks and relegating heavier industrial and manufacturing uses to specific zones, away from more noise-sensitive residential areas. Many local governments also enact ordinances that directly regulate noise through restrictions that are either qualitative (i.e., prohibitions on “unreasonable” or “excessive” noise) or quantitative (i.e., prohibitions on noise above defined numeric thresholds, often expressed in dBA, at particular places and times) in nature. These restrictions can apply broadly to all persons and entities within a municipality or, alternatively, they can target specific types of noise-intensive activities. In municipalities where oil and gas operations are common, local ordinances sometimes address noise from these facilities in specifically tailored oil and gas provisions.

In some states, oil and gas regulators have promulgated, or are considering whether to promulgate, noise control requirements that apply uniformly to all oil and gas operations within the state. These state-level noise regulations may or may not supersede local noise ordinances under evolving and varied preemption doctrines, which are developed by state courts as a matter of state law.¹¹ In the sections that follow, we provide a brief overview of the common law nuisance approach to noise issues, and then describe some of the notable oil and gas noise control regimes and initiatives from a sampling of important oil and gas producing states (and one Canadian province).

1. Common Law Doctrines Applicable to Noise

Long before the advent of regulatory approaches to noise, the common law doctrines of nuisance (and in some cases trespass) have been applied by the courts to provide redress for noise complaints.

The American Law Institute’s Restatement (Second) of Torts, which attempts to summarize the consensus common law position of the fifty states, defines a private nuisance as “a nontrespassory invasion of another’s interest in the private use and enjoyment of land.”¹² Under the Restatement, an otherwise lawful invasion must be (1) either “intentional” and “unreasonable”, or “unintentional and otherwise actionable” under rules relating to negligence, reckless conduct or abnormally dangerous activities,¹³ and (2) cause “significant” harm “of a

¹¹ See, e.g., *State ex rel. Morrison v. Beck Energy Corp.*, Slip Op. No. 2015-Ohio-485, 2015 WL 687475 (Feb. 17, 2015); *Huntley & Huntley, Inc. v. Borough Council of the Borough of Oakmont*, 964 A.2d 855 (Pa. 2009); *Range Resources–Appalachia, LLC v. Salem Twp.*, 964 A.2d 869 (Pa. 2009).

¹² Restatement (Second) of Torts § 821D (1979).

¹³ *Id.* § 822.

kind that would be suffered by a normal person in the community or by property in normal condition and used for a normal purpose”,¹⁴ in order to be actionable as a private nuisance. The “unreasonableness” of an invasion is determined by considering whether “the gravity of the harm outweighs the utility of the actor’s conduct,” taking into account a variety of factors, including the extent and character of the harm, the suitability of the parties’ respective uses of their property to the character of the locality, and the impracticability of preventing or avoiding the invasion.¹⁵ Under this multi-factor balancing test, courts exercise substantial equitable discretion in determining whether, under the fact-specific circumstances of each case, it would be justified to order the elimination or curtailment of an alleged noise nuisance.

As one example from a key shale play jurisdiction, the Pennsylvania Supreme Court has applied standards similar to the Restatement’s to determine whether an otherwise lawful pursuit qualifies as a nuisance on the basis of the noise that it generates. Perhaps the fullest recitation of the law on this point was provided in the following passage from *Molony v. Pounds*:

Cases of this character are governed by well settled legal principles. No one is entitled to absolute quiet in the enjoyment of his property. All that may be insisted upon is ***a degree of quietness consistent with the standard of comfort in the locality in which one dwells***[.] Persons living in a community or neighborhood must subject their personal comfort to the commercial necessities of carrying on trade and business, and where the individual is affected only in his taste, his personal comfort, or pleasures, or preferences, these must be surrendered to the comfort and preferences of the many[.] The use of property for other than residential purposes may be, and at times is, an annoyance to dwellers in the vicinity, but the mere fact of annoyance does not establish the existence of a nuisance and is not of itself a sufficient basis for an injunction against the particular use from which the alleged annoyance arises[.] Where the annoyance arises from the conduct of a business which is not a nuisance per se, a strong effort will be made to conserve the rights of all parties. ***An important question is, can the noise by any reasonable means be moderated so as to accord with the degree of quietness the plaintiff has a right to enjoy, and if it can, by what means***[.] In such cases, equity will not ordinarily interfere unless the proof shows that the injury arises either from an improper conduct of the business or from one that could be remedied[.]¹⁶

In *Molony*, applying these principles, the Court found that the operation of a restaurant in Conshohocken, Pennsylvania between the hours of 1 a.m. and 6 a.m., under appropriate conditions, did not constitute a nuisance that warranted abatement by court order.¹⁷ Amongst

¹⁴ *Id.* § 821F.

¹⁵ *Id.* §§ 826–831.

¹⁶ 64 A.2d 802, 803–04 (Pa. 1949) (emphasis added) (citations omitted).

¹⁷ *Id.* at 804.

other factors, the court noted the nature of the area, the relative frequency and duration of the noise, and the fact that the sounds did not result from “an improper conduct of the business or from one that could be remedied.”¹⁸

Another oft-quoted statement of the law in Pennsylvania originated in *Ebur v. Alloy Metal Wire Co.*, which provided:

The courts have found it difficult to lay down any precise and inflexible rule by the application of which it can be determined that a plaintiff in a given case is entitled to relief by injunction against smoke, fumes, and noises emitted in the vicinity of his residence. It has been said that a ‘fair test as to whether a business lawful in itself, or a particular use of property, constitutes a nuisance, is ***the reasonableness or unreasonableness of conducting the business or making the use of the property complained of in the particular locality and in the manner and under the circumstances of the case.***’ 46 C. J. 655. It has also been said: ‘Whether the use is reasonable generally depends upon many and varied facts. No hard and fast rule controls the subject. A use that would be reasonable under one set of facts might be unreasonable under another. What is reasonable is sometimes a question of law, and at other times, a question of fact. No one particular fact is conclusive, but the inference is to be drawn from all the facts proved whether the controlling fact exists that the use is unreasonable.’ 46 C. J. 656. No word is used more frequently in discussing cases of this kind than the word ‘reasonable,’ and no word is less susceptible of exact definition. What is reasonable under one set of circumstances is unreasonable under another....¹⁹

In *Ebur*, the Court modified what it determined to be an excessively restrictive lower court order with respect to the defendant’s wire and metal products factory, tailoring the injunction to preclude only noise and vibrations “***which are unnecessary and unreasonable under the circumstances, and which can be eliminated by the efficient operation of its plant*** and by the installation of the most effective reasonably available devices for the reduction of ... noises, and vibrations in its plant”²⁰

More recently, the Pennsylvania Commonwealth Court efficiently summarized the state of the law as follows: “***To constitute a nuisance based upon noise, the question is whether the noise is unreasonable and unnecessary considering all of the circumstances involved.***”²¹

Case law from other shale play states indicate that similar principles are applied in judging common law nuisance claims.

¹⁸ *Id.* at 804–05.

¹⁹ 155 A. 280, 282 (Pa. 1931) (emphasis added).

²⁰ *Id.* at 285 (emphasis added).

²¹ *Gray v. Barnhart*, 601 A.2d 924, 927 n. 4 (Pa. Cmwlth. 1992) (emphasis added).

For example, Ohio courts have noted that determination of a private nuisance is “a matter of degree” that turns on whether “the use to which the property is put is reasonably under the circumstances” and “whether there is an appreciable, substantial, tangible injury resulting in actual, material, physical discomfort.”²² In that regard, the “what amount of annoyance or inconvenience will constitute a legal injury, resulting in actual damages” cannot be “precisely defined” and is “dependent on varying circumstances” to be determined by the trier of fact.²³

West Virginia’s Supreme Court has likewise found that determination of a nuisance “is incapable of an exact and exhaustive definition”, but involves “a substantial and unreasonable interference with the private use and enjoyment of another’s land.”²⁴ In the specific context of noise, West Virginia’s courts has ruled that “noise alone may create a nuisance, depending on time, locality and degree”, and where “an unusual and recurring noise is introduced in a residential district, and the noise prevents sleep or otherwise disturbs materially the rest and comfort of the residents, the noise may be inhibited by a court of equity.”²⁵

Similarly, Texas courts have noted that the amount of annoyance and inconvenience that must be produced to constitute a nuisance depends on varying facts,²⁶ including the lawfulness of the use, the result it produces, considered in the context of the locality and surrounding uses.²⁷

In sum, in order to determine whether a particular activity constitutes a noise nuisance, the question is whether the noise is *unreasonable* considering all of the circumstances. That determination requires a consideration and weighing of the circumstances, including, but not limited to, (a) the level and frequency of the noise, (b) where it occurs, (c) when it occurs, (d) the reasonable expectations of those impacted by the noise, and (e) the ability of the persons making the noise to reasonably control it.

The hallmark of the common law approach to noise involves adjudication in the judicial system of individual, often fact-intensive disputes. Such cases are expensive, time-consuming (frequently extending well beyond the timeframe of a short duration activity), and often require presentation of competing expert testimony – ultimately leading to a jury or judge determining the issues of reasonableness and necessity, and the feasibility of control.

²² *Antonik v. Chamberlain*, 78 N.E.2d 752, 759 (Ohio Ct. App. 1947).

²³ *Columbia Gas Light and Coke Co. v. Freeland*, 12 Ohio St. 392, 399 (1961).

²⁴ *Hendricks v. Stalnaker*, 380 S.E.2d 198, 199 (W.Va. 1989), quoted in *Bansbach v. Harbin*, 728 S.E.2d 533, 537 (W.Va. 2012).

²⁵ *Burch v. Nedpower Mount Storm, LLC*, 647 S.E.2d 879, 883 (W.Va. 2007) (internal quotes and citations omitted).

²⁶ *McAfee MX v. Foster*, 2008 Tex. App. LEXIS 968 (Tex. App. 2008).

²⁷ *Gose v. Coryell*, 126 S.W. 1164, 1168 (Tex. Civ. App. 1910).

2. Pennsylvania

Pennsylvania, at the center of the shale gas revolution in the Marcellus Shale region, has taken several steps forward and back with respect to regulation of noise from oil and gas facilities.

In February 2012, Pennsylvania enacted Act 13,²⁸ a comprehensive revision to the Commonwealth's Oil and Gas Act.²⁹ In an attempt to provide regulatory uniformity to the oil and gas industry, Act 13 included several provisions that broadened the scope of state preemption of municipal authority over oil and gas facilities.³⁰ Several of these preemption provisions limited the authority of local governments to regulate noise from oil and gas facilities. Specifically, Act 13 required municipalities to authorize natural gas compressor stations as a permitted use in agricultural and industrial zoning districts, and as a conditional use in all other zoning districts, if the compressor station could achieve (among other standards) a noise level of 60 dBA at the nearest property line.³¹ Similarly, the Act required municipalities to authorize natural gas processing facilities as a permitted use in industrial districts, and as a conditional use in agricultural districts, if (among other standards) the noise level of the facility would not exceed 60 dBA at the nearest property line.³² Act 13 also prohibited municipalities from imposing noise control requirements on permanent oil and gas operations that were more stringent than requirements imposed on other industrial uses in the same zoning district – effectively preventing municipalities from singling out the oil and gas industry for special, enhanced regulatory scrutiny.³³

These statewide uniformity provisions were short-lived. In December 2013, in *Robinson Township v. Commonwealth*,³⁴ the Pennsylvania Supreme Court struck down Act 13's new preemption provisions, including the noise control sections. A plurality of the Pennsylvania Supreme Court found that the preemption provisions violated the Environmental Rights Amendment of the Pennsylvania Constitution.³⁵ The plurality's opinion³⁶ found that the state

²⁸ Act of February 14, 2012, P.L. 87, No. 13.

²⁹ 58 Pa.C.S. §§ 3201–3309.

³⁰ *Id.* §§ 3301–3309.

³¹ *Id.* § 3304(b)(7).

³² *Id.* § 3304(b)(8).

³³ *Id.* § 3304(b)(3).

³⁴ 83 A.3d 901 (Pa. 2013).

³⁵ Pa. Const. Art I, § 27.

³⁶ It is critical to note that the much-discussed lead opinion in *Robinson Township* authored by then Chief Justice Castille was issued by only a three justice plurality, and hence as a legal matter the opinion does not create binding precedent. *See, e.g., Commonwealth v. Thompson*, 985 A.2d 928, 937 (Pa. 2009) (a plurality decision “is not binding authority”).

legislature had violated its constitutional duty to protect certain environmental values and to conserve and maintain the Commonwealth's public natural resources by preventing municipalities from effectively addressing the environmental consequences of oil and gas development.³⁷ The court's decision meant that municipalities would once again have greater leeway in regulating noise and other environmental effects of oil and gas development within their borders.

Following the Supreme Court's decision (and after a change in administration at the Governor's office in 2015), the Pennsylvania Department of Environmental Protection ("PaDEP") proposed new statewide noise standards for oil and gas facilities. The proposed noise controls were unveiled in an "advanced notice of final rulemaking" in April 2015,³⁸ as part of a larger package of revisions to Pennsylvania's environmental rules for oil and gas facilities that have been in development since shortly after the enactment of Act 13 in 2012.

PaDEP's April 2015 proposal would have required operators of unconventional well sites to prepare and implement a site-specific noise mitigation plan to minimize noise during well drilling, stimulation, and servicing activities.³⁹ Under the April proposal, such plans would include: (1) an assessment of background noise in the area of the well site; (2) an assessment of known and potential noise from drilling stimulation and servicing activities, taking into consideration the interests of nearby residents; and (3) a description of the operator's plans to mitigate noise, which would have to be based on a "best practices approach" to noise management.⁴⁰ Operators would then have been required to conduct regular inspections to evaluate the effectiveness of their noise mitigation plans and take corrective actions if necessary.⁴¹ The April 2015 proposed rule would also have authorized PaDEP to order the suspension of operations if it determines during drilling, stimulation or servicing activities that a plan is inadequate to minimize noise.⁴²

PaDEP's proposal was criticized by the regulated community for combining vague requirements with a stringent enforcement mechanism. The April 2015 proposal left wide open questions: what are "best practices" and what is a "best practices approach"? To take an example, if your neighbor mows his lawn on Sunday morning, is the best practice to buy an electric mower, or switch to another day or hour? With respect to noise from roads, is the best practice to instruct truck drivers to avoid using engine break shifting, or does it require erection of sound barriers all along the road (as PennDOT does in some urban areas)? For well drilling

³⁷ 83 A.3d at 978–82.

³⁸ See 45 Pa. Bulletin 1615 (Apr. 4, 2015).

³⁹ See 25 Pa. Code § 78a.41(a) (DRAFT Mar. 9, 2015).

⁴⁰ *Id.* § 78a.41(b).

⁴¹ *Id.* § 78a.41(d) & (c)

⁴² *Id.* § 78a.41(c).

rigs, does “best practices” mandate mufflers on engines, or erection of sound barriers all around the rig? PaDEP leaders had indicated that they borrowed some of the proposed concepts from the Alberta Directive 038, discussed in Section E.7 below. But the Alberta Directive’s best practices program is encouraged, not mandated; and PaDEP’s April 2015 proposal dropped all of the definitions and explanatory discussion in the Alberta Directive. A “best practices” formulation, without definition, creates a platform for challenges from well opponents arguing that there is always something “better.” A particular measure may not be reasonable or technically practicable; but if it results in marginally lower sound levels, is it “best”?

Others questioned whether the April 2015 proposal was appropriately grounded in any authorizing statute. PaDEP had cited the general nuisance-abatement provisions of Section 1917-A of Administrative Code⁴³ (not Act 13) as the statutory basis for the proposed noise controls. That provision is directed to protection of the public against “unsanitary conditions and other nuisances,”⁴⁴ and most specifically empowers PaDEP to investigate nuisances⁴⁵ and “order such nuisances including those detrimental to the public health to be abated and removed”⁴⁶ Section 1917-A does not make any reference to “noise,” nor does it imbue the PaDEP with powers to establish standards on every possible subject or activity that might, under certain circumstances, give rise to a “nuisance.” While some Pennsylvania environmental statutes, such as the Clean Streams Law and Air Pollution Control Act, provide for establishment of standards governing air and water pollution, and declare that violation of those standards constitutes a “public nuisance,” Section 1917-A does not contain such a standard setting provision.

On August 12, 2015, PaDEP issued a news release and posted a further revised “Draft Final Rulemaking” package,⁴⁷ in which it retreated from promulgating the proposed noise control provisions. In doing so, PaDEP stated: “The Department decided not to include [§78a.41] in the draft final rulemaking. Instead, given the complex nature of the technical issues surrounding noise mitigation, the Department plans to develop a best management practices guidance document which may serve as the basis for future rulemaking on the topic.” Clearly, more to come in the months ahead as the agency contemplates drafting of a “guidance document” on the noise topic.

⁴³ 71 P.S. § 510-17.

⁴⁴ *Id.* § 510-17(1).

⁴⁵ *Id.* § 510-17(2).

⁴⁶ *Id.* § 510-17(3).

⁴⁷ Available at:

<http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/TechnicalAdvisoryBoard/2015/September%20Summary%20of%20Changes%20-%20Subchapter%20C%20Draft%20Final%20Regulation.pdf>.

3. Ohio

Unlike in Pennsylvania, Ohio's primary oil and gas law (Ohio Revised Code Chapter 1509) explicitly provides the Ohio Department of Natural Resources ("ODNR") with the authority to adopt regulations regarding noise mitigation with respect to (1) wells and production facilities in urbanized areas and (2) horizontal wells and associated production facilities.⁴⁸ ODNR promulgated a rule in 2005 with respect to urbanized areas providing that "[d]rilling, well servicing and well site maintenance operations in urbanized areas shall be conducted in a manner to mitigate noise, including the reasonable use of screening and appropriate mufflers on drilling and servicing equipment."⁴⁹ "Urbanized areas" are defined to include any municipality with a population of more than 5,000 residents according to the most recent federal census.⁵⁰ ODNR has yet to promulgate noise control rules with respect to horizontal wells (the language in ORC 1509 authorizing the promulgation of noise control rules for horizontal wells was not added until 2012).⁵¹

Thus, under Ohio's regime, the state requires all oil and gas operators with wells and production facilities in municipalities of more than 5,000 residents to mitigate noise, including the "reasonable use" of screening and "appropriate" mufflers. Ohio's oil and gas law and regulations also establish minimum setback requirements (typically 100–200 feet) from occupied dwellings and property lines.⁵² Otherwise, noise control of oil and gas facilities is governed by the common law and local governments, to the extent not preempted by ORC Chapter 1509.⁵³

4. West Virginia

In December 2011, West Virginia enacted its Natural Gas Horizontal Well Control Act⁵⁴ in response to the recent proliferation of shale gas production activities in the state. Among its many new standards for horizontal wells, the Act established new well location restrictions requiring the center of all new horizontal well pads to be located at least 625 feet from any existing occupied dwelling.⁵⁵ To assess the adequacy of this setback restriction, the Act required

⁴⁸ ORC § 1509.03(A)(6).

⁴⁹ OAC § 1501:9-9-03(I) (emphasis added).

⁵⁰ ORC § 1509.01(Y); OAC § 1501:9-1-01(A)(51).

⁵¹ See Ohio S.B. 315 (June 11, 2012).

⁵² See ORC § 1509.021; OAC § 1501:9-1-05.

⁵³ See ORC § 1509.02; *State ex rel. Morrison v. Beck Energy Corp.*, Slip Op. No. 2015-Ohio-485, 2015 WL 687475 (Feb. 17, 2015) (holding that ORC § 1509.02 preempts five City of Monroe Falls ordinances regulating oil and gas operations).

⁵⁴ West Virginia H.B. 401, passed December 14, 2011, codified at W.Va. Code Ch. 22, Art. 6A.

⁵⁵ W.Va. Code § 22-6A-12(a).

the West Virginia Department of Environmental Protection (“WVDEP”) to report to the legislature “on the noise, light, dust, and volatile organic compounds generated by the drilling of horizontal wells as they relate to the well location restrictions regarding occupied dwelling structures[.]”⁵⁶

In response to this statutory mandate, WVDEP commissioned a study by the West Virginia University (“WVU”) School of Public Health on air, noise, and light emissions from the drilling of horizontal gas wells.⁵⁷ WVU conducted monitoring activities at seven well pads for at least six days each, obtaining one-minute and one-hour noise measurements around the well pads in various stages of development (site preparation, drilling, hydraulic fracturing, flowback, and completion). WVU’s monitoring results indicated that, while noise levels at monitored locations occasionally exceeded 85 dBA, they were below the EPA “Levels Document” guideline of 70 dBA averaged over a 24-hour period (the level necessary to prevent measurable hearing loss if experienced consistently over a lifetime).⁵⁸ However, WVU’s monitoring data also indicated that noise levels were frequently above 55 dBA, the EPA guideline for preventing outdoor activity from interfering with the ability to hear and causing annoyance.⁵⁹ The study ultimately concluded that the 625 foot setback from the center of the pad would not assure that residences would be unexposed to contaminants (including sound) from drilling site activity, but that there was no simple solution to specifying a single setback distance that would eliminate all potential exposures.⁶⁰ The final study report also identified several methods for potentially reducing noise levels, particularly with respect to truck traffic, borrowing from methods typically adopted during highway construction (such as sound barriers, vegetation, building insulation, site selection, and installation of sound meters).⁶¹

Based on the results of WVU’s study, WVDEP provided a report to the West Virginia Legislature on May 28, 2013.⁶² WVDEP’s report recounted the study’s key findings with respect to noise and indicated that WVDEP had shared the study’s recommended noise reduction practices with the regulated community.⁶³ The report indicated that WVDEP works with

⁵⁶ *Id.* § 22-6A-12(e).

⁵⁷ Air, Noise, and Light Monitoring Results For Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), Prepared for WVDEP Division of Air Quality, Submitted by Michael McCawley, PhD, WVU School of Public Health (May 3, 2013).

⁵⁸ *Id.* at 2, 9, 18; EPA Condensed Levels Document at 17.

⁵⁹ *Id.* at 9–10, 18; EPA Condensed Levels Document at 24.

⁶⁰ *Id.* at 19.

⁶¹ *Id.* at 21.

⁶² WVDEP, Noise, Light, Dust, and Volatile Organic Compounds Generated by the Drilling of Horizontal Wells Related to the Well Location Restriction Regarding Occupied Dwelling Structures (May 28, 2013).

⁶³ *Id.* at 3.

individual operators and companies on a case-by-case basis to facilitate discussion and resolve citizen noise complaints, and that WVDEP inspectors would continue to work with operators to deploy sound mitigation measures, such as sound barriers, based on site specific circumstances.⁶⁴ WVDEP's report ultimately recommended that the legislature consider adopting a location restriction for occupied dwellings that relied on the limit of disturbance of the pad rather than its center point, and made no further recommendations with respect to noise controls.⁶⁵ Neither WVDEP nor the legislature has taken action to regulate noise from oil and gas operations as a result of the study.

5. Texas

Texas, like West Virginia, does not directly regulate noise from oil and gas operations through any statewide law or regulation. This is made clear on the Texas Railroad Commission's website, which explains: "The Railroad Commission of Texas has no statutory authority over noise or nuisance related issues. Noise and nuisance related issues are governed by local ordinances."⁶⁶ This continues to be the case even after the Texas legislature, on May 18, 2015, enacted H.B. 40, a bill intended to "expressly preempt the regulation of oil and gas operations by municipalities and other political subdivisions[.]"⁶⁷ While H.B. 40 imposes new limits on the authority of local governments to regulate oil and gas operations, it preserves municipal power to enact "commercially reasonable" ordinances governing "aboveground activity," including regulations controlling noise, light, traffic, and other quintessentially local concerns.⁶⁸

At the local level, the City of Fort Worth, Texas has adopted what some consider to be a model local ordinance concerning natural gas operations in urban areas.⁶⁹ This ordinance includes noise control provisions that apply specifically to natural gas wells and compressors.⁷⁰ In light of these natural gas-specific noise regulations, gas drilling and production operations are exempted from the City's broadly applicable noise ordinance.⁷¹

With regard to wells, the Fort Worth natural gas ordinance requires operators to submit a noise management plan, approved by the gas inspector, detailing how the equipment used in

⁶⁴ *Id.*

⁶⁵ *Id.* at 5.

⁶⁶ <http://www.rrc.state.tx.us/oil-gas/complaints/>.

⁶⁷ Texas H.B. 40, § 1 (May 18, 2015).

⁶⁸ *Id.* § 2; Tex. Nat. Res. Code § 81.0523(c).

⁶⁹ Fort Worth City Code, Chapter 15.

⁷⁰ *Id.* § 15-42(b), (d)(1).

⁷¹ *Id.* § 23-8(e)(7).

drilling, completion, transportation, and production of a well complies with specified maximum permissible noise levels.⁷² The plan must identify operation noise impacts, provide documentation establishing the ambient noise level prior to construction, and detail how impacts will be mitigated, considering (among other factors) the nature and proximity of adjacent developments, weather and wind patterns, vegetative cover, and topography.⁷³

The ordinance prohibits gas well operations that create noise, “measured at the protected use receiver’s/receptor’s property line or from the closest exterior point of the protected use structure or inside the protected use structure if access to the property is granted by the receiver/receptor,” that exceed the ambient noise level by more than:

- 5 decibels during daytime hours;
- 3 decibels during nighttime hours; and
- 10 decibels over the daytime average ambient noise level during fracturing operations (fracturing is prohibited during nighttime hours).⁷⁴

Upward adjustments of 10, 15, or 20 dBA to these noise standards “may be permitted intermittently” for short duration increases (e.g., a 10 dBA adjustment is permitted for a maximum of 5 cumulative minutes during any one hour).⁷⁵ Operators are also prohibited from creating pure tones and low frequency noises above specified levels.⁷⁶

Gas well operators must conduct and report the results of ambient noise monitoring over a 72-hour pre-drilling period to establish the background ambient noise level.⁷⁷ Then, once operations commence, operators must continuously monitor all gas wells within 600 feet of a protected use to ensure compliance with these standards.⁷⁸ The ordinance permits, but does not require, the use of acoustical blankets, sound walls, mufflers and other methods approved by the gas inspector to ensure compliance, and all soundproofing must comply with accepted industry standards and is subject to approval by the City’s fire department.⁷⁹ The City may issue citations for violations of the noise standards, but if a violation occurs while the operator is in compliance

⁷² *Id.* § 15-42(b)(1).

⁷³ *Id.*

⁷⁴ *Id.* § 15-42(b)(2)a.–b.

⁷⁵ *Id.* § 15-52(b)(4).

⁷⁶ *Id.* § 15-42(b)(2)d.–e.

⁷⁷ *Id.* § 15-42(b)(3).

⁷⁸ *Id.* § 15-42(b)(6).

⁷⁹ *Id.* § 15-42(b)(7).

with its approved noise management plan, the operator must first be given 24 hours to correct the violation.⁸⁰

With respect to compressors (both at the well site and along pipelines), the ordinance establishes the following maximum permitted sound levels, measured at the property line of the receiver/receptor:⁸¹

Industrial	75 dBA day / 65 dBA night
Commercial	65 dBA day / 55 dBA night
Residential	55 dBA day / 50 dBA night

The ordinance allows pipeline compressor operators to demonstrate that the current actual ambient noise level is above these levels.⁸² Certain allowances are also made for temporary lift compressors at well sites, while permanent lift compressors are required to comply with additional standards regarding the use of acoustical structures, such as a prohibition on the use of sound blankets.⁸³

Fort Worth's detailed oil and gas noise regulations have the benefit of establishing clear requirements for the regulated community. However, the rules also introduce potentially time-consuming and costly obligations, such as mandatory noise management plans and pre-and post-drilling ambient noise monitoring, which would be difficult to justify in less populated settings.

6. Colorado

Unlike the states discussed in the preceding paragraphs, Colorado has adopted detailed statewide oil and gas-specific noise control regulations. These noise abatement requirements appear at § 802 of the Colorado Oil and Gas Conservation Commission's ("COGCC") oil and gas rules.⁸⁴

COGCC's noise control regulations require oil and gas operations at any well site, production facility, or gas facility (defined to include all facilities that process or compress

⁸⁰ *Id.* § 15-42(b)(9).

⁸¹ *Id.* § 15-42(d)(1).

⁸² *Id.* § 15-42(d)(1)b.

⁸³ *Id.* § 15-42(d)(2)b.

⁸⁴ 2 CCR § 401-1:802 ("COGCC Rule 802")

natural gas prior to the point of transfer to a carrier for transportation)⁸⁵ to comply with the following maximum permissible noise levels:⁸⁶

ZONE	7:00 am to 7:00 pm	7:00 pm to 7:00 am
Residential/Agricultural/Rural	55 dBA	50 dBA
Commercial	60 dBA	55 dBA
Light industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA

These noise levels may be increased 10 dBA for periods not to exceed 15 minutes in any one hour period during the daytime (7:00 am to 7:00 pm). The allowable noise level for “periodic, impulsive or shrill noises” is reduced by 5 dBA from the above levels.⁸⁷

Compliance with these noise standards is ordinarily determined through measurements taken 350 feet from the noise source. However, if an oil and gas facility is installed closer than 350 feet from an existing occupied structure, sound is measured at a point 25 feet from the structure towards to the noise source. If measurements at 350 feet would be impractical or unrepresentative due to topography, they may be taken at a lesser distance and extrapolated to 350 feet using a mathematical formula. A complainant may also request measurement at a further distance in order to obtain a more representative noise sample.⁸⁸ When low frequency noise may be an issue, the COGCC will take additional measurements 25 feet from the occupied structure towards the noise source and, if the reading exceeds 65 dBC, require the operator to obtain a low frequency impact analysis by a qualified sound expert.⁸⁹

Measurements are to be taken four feet above ground level, when wind is not more than 5 miles per hour.⁹⁰ Results are determined by averaging minute-by-minute measurements made over a minimum 15 minute sample duration (if practicable).⁹¹ Furthermore, “[i]n all sound level measurements, the existing ambient noise level from all other sources in the encompassing environment at the time and place of such sound level measurement shall be considered to determine the contribution to the sound level by the oil and gas operation(s).”⁹²

⁸⁵ COGCC Rule 100.

⁸⁶ COGCC Rule 802.b.

⁸⁷ *Id.*

⁸⁸ COGCC Rule 802.c.(1)

⁸⁹ COGCC Rule 802.d.

⁹⁰ COGCC Rule 802.c.(2)–(3).

⁹¹ COGCC Rule 802.c.(4).

⁹² COGCC Rule 802.c.(5).

The applicable land use designation is determined by COGCC in consultation with the local government, taking into account (but not definitively decided by) any local zoning designation.⁹³ However, the maximum noise level for industrial zones applies to all operations involving pipeline or gas facility installation or maintenance, the use of a drilling rig, completion rig, workover rig, or stimulation⁹⁴ (unless the operation is within certain designated setback locations, in which case the light industrial zone designation applies).⁹⁵ In remote locations where there is no “reasonably proximate” occupied structure or “Designated Outside Activity Area” (such as a playground or park),⁹⁶ “the light industrial standard may be applicable.”⁹⁷

Colorado’s rules do not dictate the use of any particular noise control practices, other than a requirement to equip non-electric engines and motors with quiet design mufflers “or equivalent” if within 400 feet of residential and commercial buildings.⁹⁸ Thus, the rules provide significant leeway to operators to decide how to achieve compliance with the applicable maximum noise level.

7. Alberta, Canada

The Canadian province of Alberta is often regarded as having one of the most comprehensive noise control regimes for the energy industry in North America. Alberta’s Directive 038, which is enforced by the Alberta Energy Regulator (“AER”), establishes noise controls for a variety of licensed energy generation activities, including operations involving oil and gas, coal, oil sands, fossil fuel fired electric generation plants and wind energy development.⁹⁹ The Directive is designed to address environmental noise, not health related impacts (such as noise-induced hearing loss), aiming to ensure that covered energy facilities do “not adversely affect indoor noise levels for residents near the facility.”¹⁰⁰

Directive 038 considers noise at the point of the receptor rather than at the property line, “allow[ing] a licensee to take maximum advantage of the normally substantial distance in rural areas between a facility and any dwellings.”¹⁰¹ The only exception is for facilities in remote

⁹³ COGCC Rule 802.b.

⁹⁴ COGCC Rule 802.b.(1).

⁹⁵ COGCC Rule 604.c.(2)A.

⁹⁶ COGCC Rule 100.

⁹⁷ COGCC Rule 802.b.(2).

⁹⁸ COGCC Rule 802.f.

⁹⁹ AER Directive 038: Noise Control, § 1.4 (Feb. 16, 2007).

¹⁰⁰ *Id.* §§ 1.1, 1.2.1.

¹⁰¹ *Id.* § 1.2.2.

areas where no receptor is present, in which case a permissible sound level of 40 dBA energy equivalent sound level (“Leq”)¹⁰² at nighttime must be met at 1.5 km.¹⁰³

For all other facilities, the permissible sound level is determined using a basic sound level (“BSL”) plus a series of potential adjustments.¹⁰⁴ The BSL (which applies during the night) ranges from 40 to 56 dBA Leq depending on the density of development in the area.¹⁰⁵ A +10 dBA Leq adjustment is made for daytime noises (from 7 a.m to 10 p.m).¹⁰⁶ “Class A” adjustments may be made based on the season (+5 dBA Leq during the winter) and the monitored ambient sound level in the area (ranging from -10 to +10 dBA Leq).¹⁰⁷ “Class B” adjustments may be made if the activity will only last for a short duration; the maximum Class B adjustment is +15 dBA Leq for an activity lasting only one day; the minimum is +5 dBA Leq for an activity lasting up to 60 days.¹⁰⁸ The Directive also recognizes that there will be some “special cases” where the permissible sound levels should be adjusted based on exceptional site-specific circumstances.¹⁰⁹

Before submitting an application for a new facility or modification to an existing facility, Directive 038 requires licensees to conduct a noise impact assessment (“NIA”) if there is a “reasonable expectation” of a continuous noise source or changes to existing noise sources.¹¹⁰ “Drilling and servicing rigs,” however, are considered to be only temporary activities that generally do not require an NIA.¹¹¹ For those oil and gas activities requiring an NIA, licensees must model the predicted sound level for the facility once put into operation.¹¹² The modeled cumulative noise level in the area (including the proposed facility) must not exceed the applicable permissible sound level.¹¹³

¹⁰² Energy equivalent sound level (Leq) “is the average weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measure over a time period interval.” *Id.* Appendix 1. The Leq concept is described in greater detail in Appendix 3 of Directive 038.

¹⁰³ *Id.* §§ 1.2.2, 2.1.

¹⁰⁴ *Id.* § 2.1.

¹⁰⁵ *Id.* § 2.1.1

¹⁰⁶ *Id.* § 2.1.2.1.

¹⁰⁷ *Id.* § 2.1.2.2.

¹⁰⁸ *Id.* § 2.1.2.3.

¹⁰⁹ *Id.* § 2.1.3.

¹¹⁰ *Id.* § 3.2.

¹¹¹ *Id.*

¹¹² *Id.* §§ 3.1, 3.5.

¹¹³ *Id.* § 3.4.

Directive 038 establishes a rigorous noise complaint investigation process to ensure that facilities are in compliance with permissible sound levels.¹¹⁴ Alternatively, if for some reason a compliance survey is not practical, a detailed “Noise Management Plan” approved by AER can be used to establish compliance.¹¹⁵

While noise from heavy truck traffic is not specifically addressed in the Directive, the Directive indicates that receipt of a complaint with regard to oil and gas-related truck traffic may require corrective action from the licensee on a site-specific basis.¹¹⁶ Oil and gas licensees are “expected to take every reasonable measure to avoid or minimize the noise impacts of heavy truck traffic and vibration.”¹¹⁷

Finally, the Alberta Directive “encourage[s],” but does not require, all licensees to adopt and incorporate a “best practices approach” to noise management.¹¹⁸ This stands in contrast to the regulations proposed by Pennsylvania in April 2015, which would have mandated operators to adopt and incorporate a best practices approach, without specifying what is included in such an approach.¹¹⁹ For its part, Directive 038 indicates that a best practices approach “may include such things as taking regular fence-line measurements to determine if there are any significant changes to sound emanating from the facility and improving notification measures to neighbours of a planned noisy event.”¹²⁰ Relatedly, the Directive also indicates that, during the noise impact assessment planning process, licensees should consider adopting “best practical technology (accounting for cost versus benefit) ... to minimize the potential noise impact to existing dwellings.”¹²¹

This brief evaluation only skims the technical aspects of determining permissible sound levels, modeling and monitoring noise levels, and investigating compliance under Directive 038. In this regard, Directive 038 is significantly more detailed than the state and local noise mitigation schemes discussed in the preceding sections of the paper. In the future, it would not be surprising if U.S. regulators considered and borrowed some of the concepts from Alberta Directive 038 for inclusion in their own regulatory programs.

¹¹⁴ *Id.* § 4; *see also id.* § 1.4.1.

¹¹⁵ *Id.* § 5.1; *see also id.* § 1.4.1.

¹¹⁶ *Id.* § 1.4.1

¹¹⁷ *Id.*

¹¹⁸ *Id.* § 1.2.4.

¹¹⁹ 25 Pa. Code § 78a.41(a)(3) (DRAFT Mar. 9, 2015).

¹²⁰ Directive 038, § 1.2.4.

¹²¹ *Id.* § 3.1.

F. CONCLUSION

Noise generation, management and mitigation is, and will remain, an ongoing challenge for the shale oil and gas sector. Development of shale plays bring oil and gas operators into the proximity of numerous communities across the nation which heretofore have had little to no contact with the industry. While many of the noise impacts of shale play surface operations are relatively temporary in nature, neighbors and communities who have been accustomed to the quietude of the rural landscape may be intolerant of even temporary intrusions. Regulatory responses to such noise issues continue to evolve, much as have evolved regulatory programs in on environmental topics. An important opportunity for the industry would be to move from a reactive to a proactive stance, formulating and advocating approaches that are flexible and adaptive to particular conditions, cost-effective and practical.

TAB DD



LOUDNESS COMPARISON CHART (dBA)

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Jet Fly-over at 1000 ft	110	Rock Band
Gas Lawn Mower at 3 ft	100	
	90	Food Blender at 3 ft
Diesel Truck at 50 ft at 50 mph	80	Garbage Disposal at 3 ft
Noisy Urban Area, Daytime	70	Vacuum Cleaner at 10 ft
Gas Lawn Mower at 100 ft		Normal Speech at 3 ft
Commercial Area	60	
Heavy Traffic at 300 ft		Large Business Office
Quiet Urban, Daytime	50	Dishwasher Next Room
Quiet Urban, Nighttime	40	Theater, Large Conference Room (Background)
Quiet Suburban, Nighttime	30	Library
	20	Bedroom at Night, Concert Hall (Background)
	10	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

An increase of 3 dBA is barely perceptible to the human ear.



TABLE



Daniel Skolnick <daniel.skolnick@lacity.org>

Freeport-McMoRan Oil & Gas Request To Drill

Kara Clemins <clemins@usc.edu>

Sat, Sep 21, 2013 at 12:38 PM

To: Daniel.skolnick@lacity.org

To whom it may concern,

My name is Kara Clemins and I am a recent resident of Van Buren Place. My apartment is directly next to the oil company and upon moving in I was shocked to find out who my neighbors were. I am concerned about the health implications of living next to a company that wishes to ramp up it's production. They do not maintain their property and create problems for those who live around them.

The company is constantly a nuisance on the street and is extremely loud in the mornings. There seems to be no concern for the neighborhood and I feel that giving them more freedom would be detrimental. I also find it disconcerting that they would first not notify us of the plan and secondly attempt to waive a public hearing. I would like to know why we were not notified as the neighborhood, especially those of us directly next to the drilling, were not made aware of these plans. Please reconsider giving this company more freedoms without checking the many negative things they have done in our neighborhood.

Thank you for your time.

Best,

Kara Clemins

TAB FF

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants



February 15, 2006

Plains Exploration & Production Company
5640 South Fairfax Avenue
Los Angeles, CA 90056

Attention: Edgar Salazar

Subject: Ambient Noise Survey, Drilling Impact Evaluation and Mitigation Report

Reference: Jefferson Drill Site, 1349-1375 Jefferson Boulevard, Los Angeles, CA

Dear Mr. Salazar:

We have completed a 36 hour pre-drilling ambient sound level survey at the Plains Exploration & Production Company (PXP) Jefferson Drill Site located at 1349-1375 Jefferson Boulevard and have completed a drilling noise impact evaluation for the subject drilling site. Please find following the report of our findings including the required drilling noise mitigation systems and recommended compliance verification procedures.

Distances from Critical Receivers

To ensure conservatism in our noise impact analysis, the ambient sound level survey was completed at the property line nearest to the proposed wellhead and adjacent to critical off-site receivers at the Jefferson Drill Site. The ambient pre-drilling sound measurement location is indicated on the attached site aerial photograph of this site. The distance to the nearest residential property receiver from the proposed well head location on the west side of the Jefferson Drilling Site is approximately 100 feet. The site is located within a residential neighborhood with residential structures located on all four sides of the site. The drilling site is completely enclosed with a block wall, ranging from 8 to 10 feet high on all four sides.

Pre-drilling Ambient Sound Levels

To establish and document the 24-hour pre-drilling ambient sound levels at the drilling site location, a Type 1 Quest Model 1900 Integrating/Logging Sound Level Meter was programmed and deployed to measure and calculate hourly average sound levels (Leq), hourly maximum sound levels (Lmax), hourly peak sound levels (LPeak), L10, L90, average day/night levels (Ldn), and the Community Noise Exposure Level (CNEL). The meter and power source was located within a locked security enclosure with the recording microphone positioned on top of the enclosure attached to an existing pole approximately 9 feet above ground level above the existing block wall at the location indicated on the attached site aerial photograph.

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants



Plains Exploration & Production Company

February 15, 2006

Page 2

To ensure adequate ambient base line sound data is documented on all four sides of the drilling site, we are currently collecting additional 24 hour sound level data at the site. This data will be used as a baseline during the drilling of the wells to ensure sound level compliance.

The 24 hour ambient sound level measurement meter at the Jefferson Drilling Site was positioned on a pole at the west property line, above the existing block wall at the nearest wellhead to the property line. The sound level survey commenced at 3:50 PM on Wednesday, December 21 and ran continuously through 9:50 AM on Friday, December 23, 2005. The average hourly daytime ambient sound level ranged from a high of 73 dBA to a low of 67 dBA with the nighttime average hour level ranging from a low of 65 dBA to a high of 67 dBA, as shown in the attached data graph. The tabulated measured sound level data is has also been included.

The measured ambient sound levels represents the current typical daytime/nighttime ambient sound levels at the property line of the drilling site without drilling activities. The existing equipment at the site including pumps and compressors generate an elevated, relatively steady background sound level at the site's property line. The current City of Los Angeles municipal noise code levels for residential zones is 50 dB between 7:00 AM and 10:00 PM and 40 dB between 10:00 PM and 7:00 AM, or the level of the existing ambient sound, which ever is higher.

Drilling Noise Level Impacts

A noise impact evaluation of the projected well drilling activity on the existing ambient levels at the property lines of the drilling site was completed using current measured noise level data from drilling activities of the Caza Rig #729 drilling rig, which was recently drilling in Baldwin Hills. This drilling rig, or a similar size drilling rig will be used for the drilling the wells at the Jefferson site. The drilling sound level at 50 feet was used as the bases for impact analysis.

The measured average daytime noise levels without traffic noise at 50 feet, with direct line of site to the Caza drilling rig with a 30 foot high sound wall ranged from 66 to 68 dBA during the running of casing, which has been established as the highest noise generation activity associated with oil well drilling. The measured average nighttime noise levels without traffic noise at 50 feet, with direct line of site to the drilling rig with a 30 foot high sound wall ranged from 62 to 65 dBA.

Peak noise levels ranged between 68 and 75 dBA at 50 feet with a 30 foot high sound wall. Peak intermittent noise is generated primarily from the drilling rig's draw works, brakes, pipe handling and material deliveries and unloads at the site.

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants



Plains Exploration & Production Company

February 15, 2006

Page 3

Based on the measured drilling rig noise levels and current ambient sound levels at the property line of nearest off-site receptor with a temporary 30 foot high sound wall installed, a 3 to 6 dBA increase in the current ambient hourly sound levels are projected. This level is determined by adding the existing ambient sounds with the additional noise generated from the drilling operation at a distance of 50 feet.

Drilling Noise Mitigation

To achieve the necessary 3 to 6 dBA hourly average sound reduction and to reduce or eliminate intermittent noise impact to close proximity neighbors, it is recommended that PXP install the following sound mitigation systems and implement administrative noise controls as follows:

- 1.) Erect a 30 foot high blanket sound wall on three sides of the drilling rig at the Jefferson drilling site (west, north and east), with the layout and wall lengths determined after the drilling rig and equipment positioning has been established. Install the sound wall as close as possible to the drilling rig and associated equipment with no gaps or openings in the walls. The sound wall material should have a minimum STC rating of 25. We recommend sound wall gates be installed with the same sound loss rating as the wall material and that the gate be closed at all times except for material delivery or pick up.
- 2.) Enclose the drilling rig floor with STC-25 rated acoustical barrier blankets. The blankets height should be a minimum of 10 ft above the drilling rig floor and have a closable panel at V door, which should be closed except when running casing, pipe, tubing or logging.
- 3.) To reduce sound from the drilling rigs sub-structure, acoustical blankets are recommended to be hung from the exterior of the rig floor down to the ground, covering the open area of the rig sub-structure on the side of the rig facing the north property line.
- 4.) The stabbing platform on the rigs derrick should be required to be enclosed with STC-25 rated acoustical blankets.
- 5.) To mitigate the drilling rig draw works and brake noise level, sound damping acoustical material should be installed and maintained during drilling activities.
- 6.) Position all ancillary noise generation equipment away from the nearest critical receptors when feasible and install temporary sound enclosures, where possible on all noise generation equipment and operations.

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants



Plains Exploration & Production Company

February 15, 2006

Page 4

- 7.) Install vibration isolation pads on shaker units and provide low frequency designed sound absorption and barring panels adjacent to the shaker units.
- 8.) Implement PXP "quiet mode" operation procedures including limitation of material delivery schedules and other sound mitigation requirements.
- 9.) To ensure adequate sound mitigation has been installed, and to identify any unusual or unique noise problems, sound level measurement and testing should be complete as the rig starts up operations. To verify and document sound level compliance, continuous sound level measurement and monitoring may be considered during all drilling activity.

Please contact me with any questions or comments.

Very truly yours,

Don Behrens
President

95-4460624

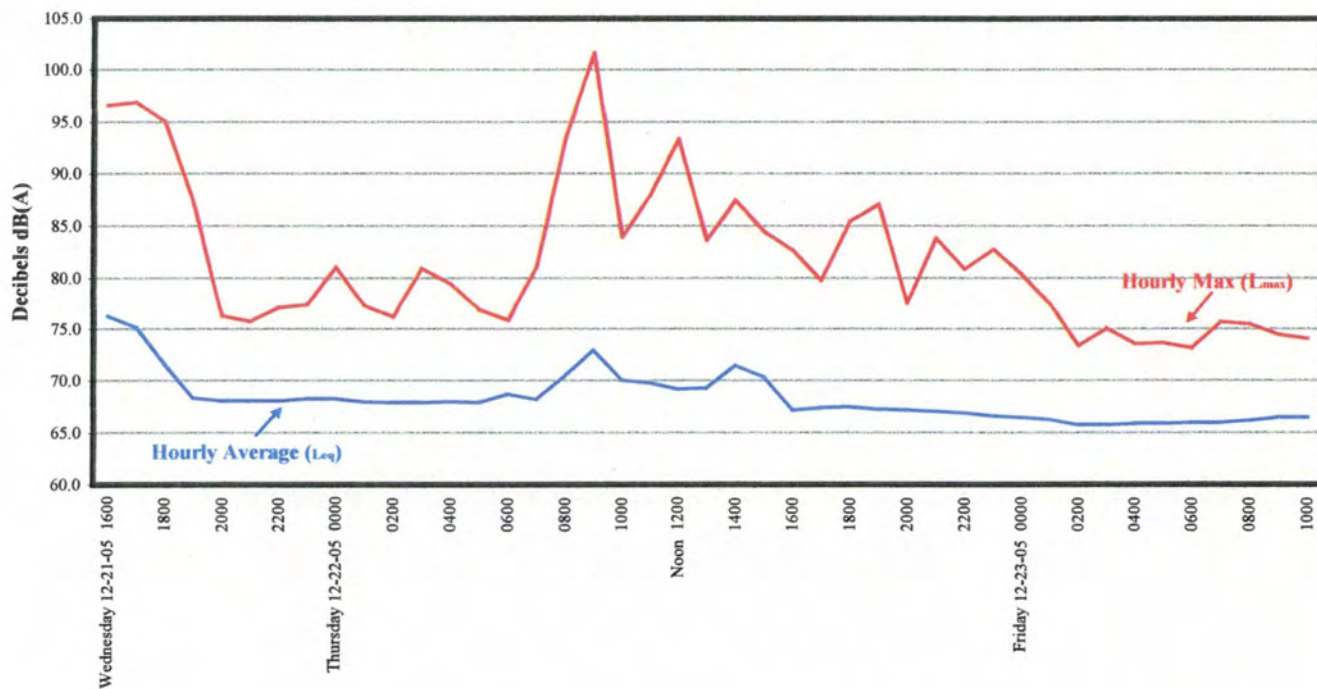
Attachments

Date / Time	Hourly Average (L_{eq})	Hourly Max (L_{max})
Wednesday 12-21-05 1600	76.3	96.6
1700	75.2	96.9
1800	71.7	95.1
1900	68.4	87.4
2000	68.1	76.3
2100	68.1	75.8
2200	68.1	77.1
2300	68.3	77.4
Thursday 12-22-05 0000	68.3	81.1
0100	68.0	77.3
0200	67.9	76.2
0300	67.9	81.0
0400	68.0	79.5
0500	67.9	76.9
0600	68.7	75.9
0700	68.2	81.1
0800	70.5	93.6
0900	73.0	101.7
1000	70.1	84.0
1100	69.8	88.0
Noon 1200	69.2	93.4
1300	69.3	83.7
1400	71.5	87.5
1500	70.4	84.5
1600	67.2	82.7
1700	67.4	79.8
1800	67.5	85.5
1900	67.3	87.1
2000	67.2	77.6
2100	67.1	83.9
2200	66.9	80.9
2300	66.6	82.8
Friday 12-23-05 0000	66.5	80.4
0100	66.3	77.5
0200	65.8	73.4
0300	65.8	75.1
0400	65.9	73.6
0500	65.9	73.7
0600	66.0	73.2
0700	66.0	75.7
0800	66.2	75.5
0900	66.5	74.5
1000	66.5	74.1

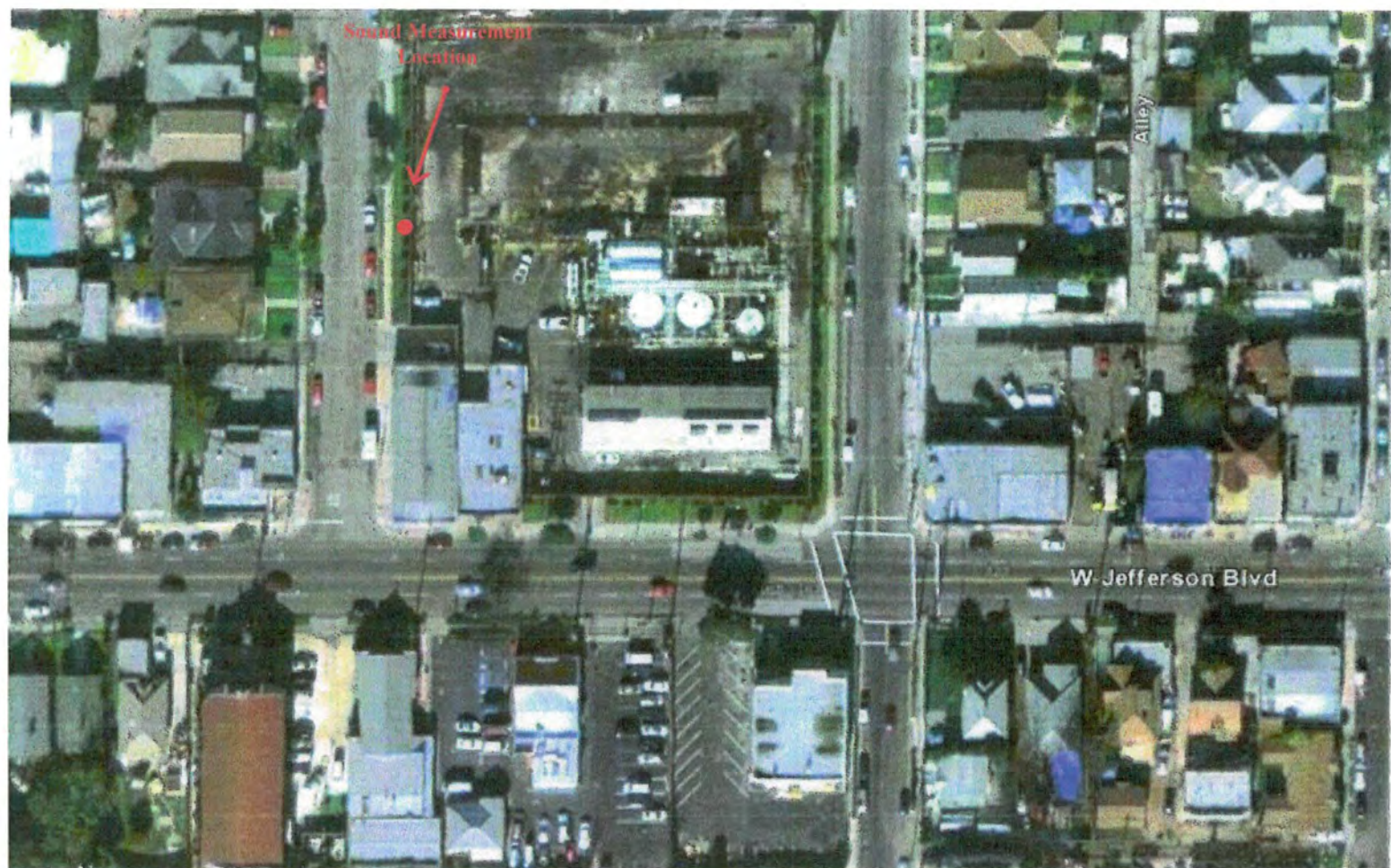
Plains Exploration and Production Company
Ambient Sound Level Survey
1349 Jefferson Boulevard, Los Angeles, California
Wednesday 12-21 – Friday 12-23, 2005

Behrens and Associates, Inc.

Acoustics, Noise and Vibration Consultants



Plains Exploration and Production Company
Ambient Sound Measurement Location
1349 Jefferson Boulevard, Los Angeles California
Wednesday 12-21 – Friday 12-22, 2005



**Plains Exploration and Production Company
Ambient Sound Measurement Location
1349 Jefferson Boulevard, Los Angeles California
Wednesday 12-21 – Friday 12-22, 2005**

TAB GG

Missing the Dark

Health Effects of Light Pollution





In 1879, Thomas Edison's incandescent light bulbs first illuminated a New York street, and the modern era of electric lighting began. Since then, the world has become awash in electric light. Powerful lamps light up streets, yards, parking lots, and billboards. Sports facilities blaze with light that is visible for tens of miles. Business and office building windows glow throughout the night. According to the Tucson, Arizona-based International Dark-Sky Association (IDA), the sky glow of Los Angeles is visible from an airplane 200 miles away. In most of the world's large urban centers, stargazing is something that happens at a planetarium. Indeed, when a 1994 earthquake knocked out the power in Los Angeles, many anxious residents called local emergency centers to report seeing a strange "giant, silvery cloud" in the dark sky. What they were really seeing—for the first time—was the Milky Way, long obliterated by the urban sky glow.

None of this is to say that electric lights are inherently bad. Artificial light has benefited society by, for instance, extending the length of the productive day, offering more time not just for working but also for recreational activities that require light. But when artificial outdoor lighting becomes inefficient, annoying, and unnecessary, it is known as light pollution. Many environmentalists, naturalists, and medical researchers consider light pollution to be one of the fastest growing and most pervasive forms of environmental pollution. And a growing body of scientific research suggests that light

Mark A. Johnson/Alamy



Glare, overillumination, and sky glow (which makes the sky over a city look orange, yellow, or pink) are all forms of light pollution. These photos were taken in Goodwood, Ontario, a small town about 45 minutes northeast of Toronto during the night after the regionwide 14 August 2003 blackout. The lights inside the house in the blackout picture were created by candles and flashlights.

pollution can have lasting adverse effects on both human and wildlife health.

When does nuisance light become a health hazard? Richard Stevens, a professor and cancer epidemiologist at the University of Connecticut Health Center in Farmington, Connecticut, says light photons must hit the retina for biologic effects to occur. “However, in an environment where there is much artificial light at night—such as Manhattan or Las Vegas—there is much more opportunity for exposure of the retina to photons that might disrupt circadian rhythm,” he says. “So I think it is not only ‘night owls’ who get those photons. Almost all of us awaken during the night for periods of time, and unless we have blackout shades there is some electric lighting coming in our windows. It is not clear how much is too much; that is an important part of the research now.”

According to “The First World Atlas of the Artificial Night Sky Brightness,” a report on global light pollution published in volume 328, issue 3 (2001) of the *Monthly Notices of the Royal Astronomical Society*, two-thirds of the U.S. population and more than one-half of the European population have already lost the ability to see the Milky Way with the naked eye. Moreover, 63% of the world population and 99% of the population of the European Union and the United

States (excluding Alaska and Hawaii) live in areas where the night sky is brighter than the threshold for light-polluted status set by the International Astronomical Union—that is, the artificial sky brightness is greater than 10% of the natural sky brightness above 45° of elevation.

Light pollution comes in many forms, including sky glow, light trespass, glare, and overillumination. Sky glow is the bright halo that appears over urban areas at night, a product of light being scattered by water droplets or particles in the air. Light trespass occurs when unwanted artificial light from, for instance, a floodlight or streetlight spills onto an adjacent property, lighting an area that would otherwise be dark. Glare is created by light that shines horizontally. Overillumination refers to the use of artificial light well beyond what is required for a specific activity, such as keeping the lights on all night in an empty office building.

Distracted by the Light

The ecologic effects of artificial light have been well documented. Light pollution has been shown to affect both flora and fauna. For instance, prolonged exposure to artificial light prevents many trees from adjusting to seasonal variations, according to Winslow Briggs’s chapter on plant responses in

the 2006 book *Ecological Consequences of Artificial Night Lighting*. This, in turn, has implications for the wildlife that depend on trees for their natural habitat. Research on insects, turtles, birds, fish, reptiles, and other wildlife species shows that light pollution can alter behaviors, foraging areas, and breeding cycles, and not just in urban centers but in rural areas as well.

Sea turtles provide one dramatic example of how artificial light on beaches can disrupt behavior. Many species of sea turtles lay their eggs on beaches, with females returning for decades to the beaches where they were born to nest. When these beaches are brightly lit at night, females may be discouraged from nesting in them; they can also be disoriented by lights and wander onto nearby roadways, where

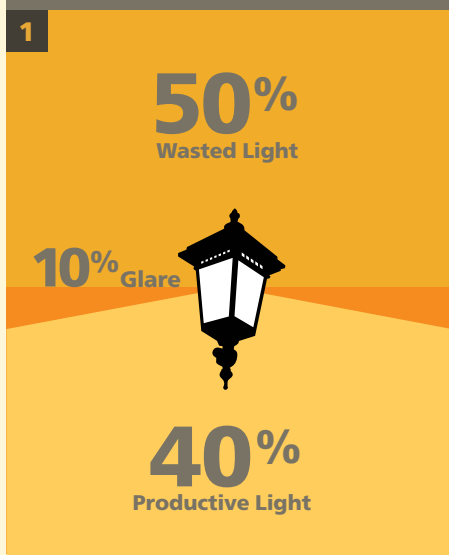
they risk being struck by vehicles.

Moreover, sea turtle hatchlings normally navigate toward the sea by orienting away from the elevated, dark silhouette of the landward horizon, according to a study published by Michael Salmon of Florida Atlantic University and colleagues in volume 122, number 1–2 (1992) of *Behaviour*. When there are artificial bright lights on the beach, newly hatched turtles become disoriented and navigate toward the artificial light source, never finding the sea.

Jean Higgins, an environmental specialist with the Florida Wildlife Conservation Commission Imperiled Species Management Section, says disorientation also contributes to dehydration and exhaustion in hatchlings. “It’s hard to say if the ones that have made it into the water aren’t more susceptible to predation at this later point,” she says.

Bright electric lights can also disrupt the behavior of birds. About 200 species of birds fly their migration patterns at night over North America, and especially during inclement weather with low cloud cover, they routinely are confused during passage by brightly lit buildings, communication towers, and other structures. “Light attracts birds and disorients them,” explains Michael Mesure, executive director of the Toronto-based Fatal Light Awareness Program (FLAP), which

How Outdoor Lighting Translates into Light Pollution



According to the National Park Service, 50% of the light from a typical unshielded light fixture is wasted, shining upward where it is not needed (figure 1). About 40% of the light shines downward to illuminate the intended target. Light emitted horizontally tends to create glare.

Globe lights typically distribute light poorly and contribute to glare (figure 2). Floodlights can fill a space with light, but they may be too bright for their intended task, and much of the light is wasted (figure 3).

Good lighting is shielded in a manner that directs all the light where it is needed and wanted. The International Dark-Sky Association (IDA) recommends that all lighting be installed such that no light is emitted above a horizontal plane running through the lowest part of the fixture (figure 4).

IDA further recommends the use of low-pressure sodium (LPS) lights wherever possible. LPS lights are the most energy-efficient lights currently available. They emit a yellow light at the wavelength where the human eye is most sensitive, but the monochromatic light makes it difficult to distinguish the colors of objects below. For outdoor lighting where color perception is important (to enhance security, for instance), IDA recommends high-pressure sodium lights.

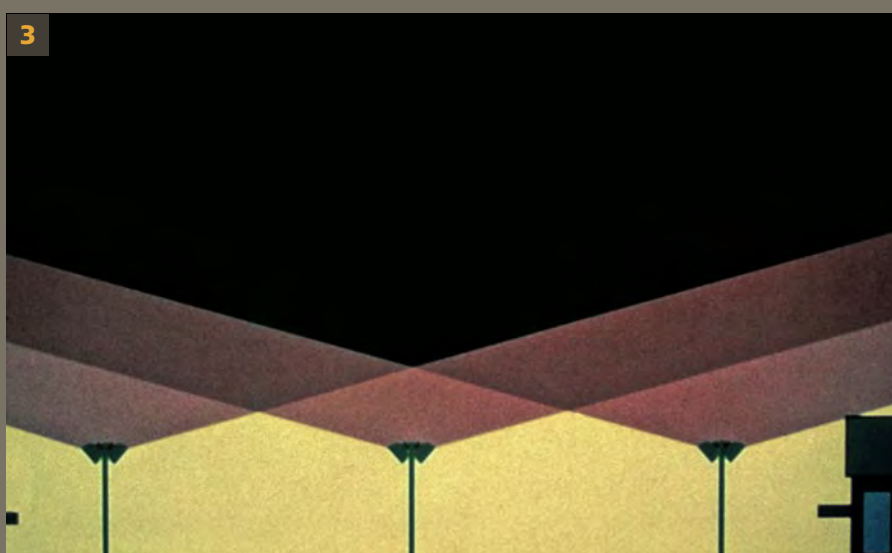
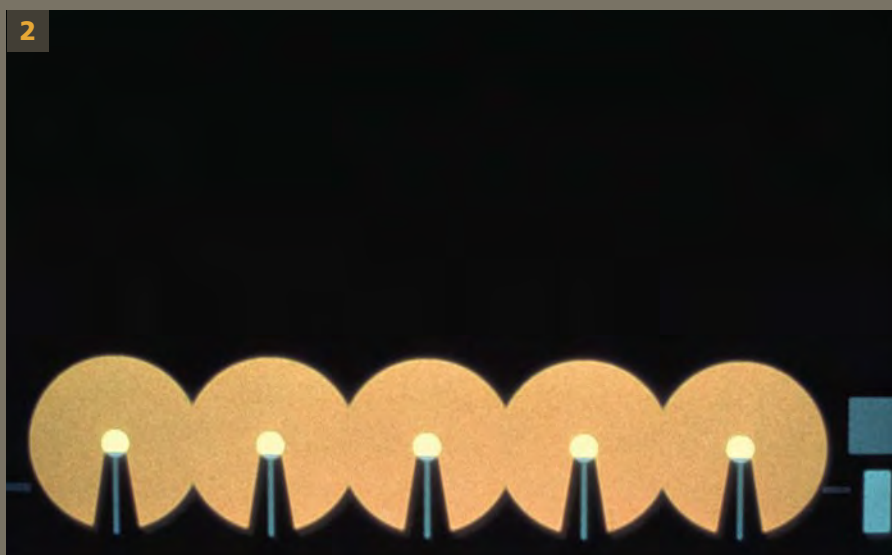


Figure 1: U.S. National Park Service, Matthew Ray/EHP; figures 2–4: International Dark-Sky Association

works to safeguard migratory birds in the urban environment. “It is a serious situation because many species that collide frequently are known to be in long-term decline and some are already designated officially as threatened.”

Each year in New York City alone, about 10,000 migratory birds are injured or killed crashing into skyscrapers and high-rise buildings, says Glenn Phillips, executive director of the New York City Audubon Society. The estimates as to the number of birds dying from collisions across North America annually range from 98 million to close to a billion. The U.S. Fish and Wildlife Service estimates 5–50 million birds die each year from collisions with communication towers.

Turtles and birds are not the only wildlife affected by artificial nighttime lighting. Frogs have been found to inhibit their mating calls when they are exposed to excessive light at night, reducing their reproductive capacity. The feeding behavior of bats also is altered by artificial light. Researchers have blamed light pollution for declines in populations of North American moths, according to *Ecological Consequences of Artificial Night Lighting*. Almost all small rodents and carnivores, 80% of marsupials, and 20% of primates are nocturnal. “We are just now understanding the nocturnality of many creatures,” says Chad Moore, Night Sky Program manager with the National Park Service. “Not protecting the night will destroy the habitat of many animals.”

Resetting the Circadian Clock

The health effects of light pollution have not been as well defined for humans as for wildlife, although a compelling amount of epidemiologic evidence points to a consistent association between exposure to indoor artificial nighttime light and health problems such as breast cancer, says George Brainard, a professor of neurology at Jefferson Medical College, Thomas Jefferson University in Philadelphia. “That association does not prove that artificial light causes the problem. On the other

hand, controlled laboratory studies do show that exposure to light during the night can disrupt circadian and neuroendocrine physiology, thereby accelerating tumor growth.”

The 24-hour day/night cycle, known as the circadian clock, affects physiologic processes in almost all organisms. These processes include brain wave patterns, hormone production, cell regulation, and other biologic activities. Disruption of the circadian clock is linked to several medical disorders in humans, including depression, insomnia, cardiovascular disease, and cancer, says Paolo Sassone-Corsi, chairman of the Pharmacology Department at the University of California, Irvine, who has done extensive research on the circadian clock. “Studies show that the circadian cycle controls from ten to fifteen percent of our genes,” he explains. “So the disruption of the circadian cycle can cause a lot of health problems.”

On 14–15 September 2006 the National Institute of Environmental Health Sciences (NIEHS) sponsored a meeting that focused on how best to conduct research on possible connections between artificial lighting and human health. A report of that meeting in the September 2007 issue of *EHP* stated, “One of the defining characteristics of life in the modern world is the altered patterns of light and dark in the built environment made possible by use of electric power.” The meeting report authors noted it may not be

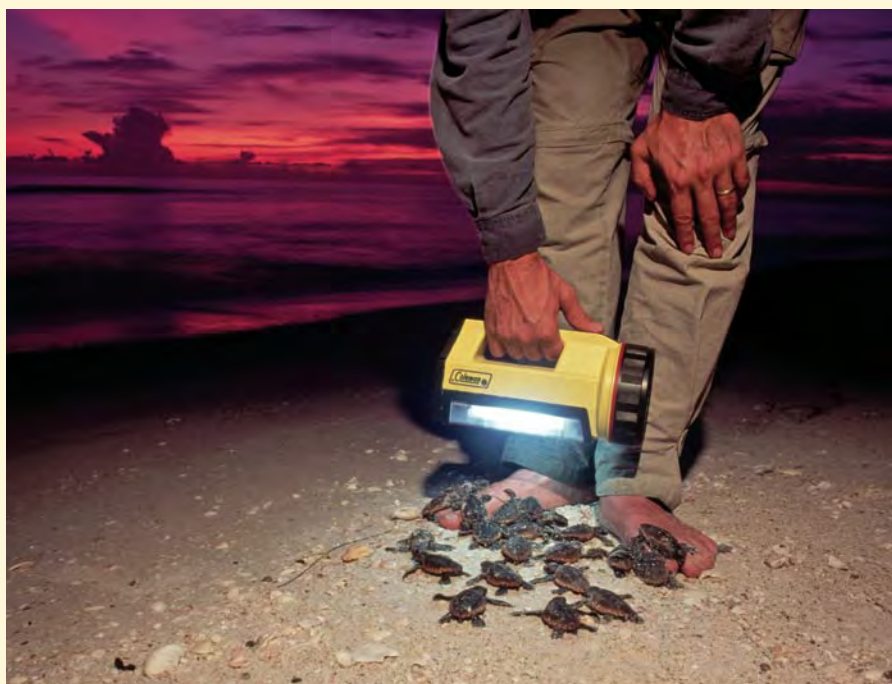
entirely coincidental that dramatic increases in the risk of breast and prostate cancers, obesity, and early-onset diabetes have mirrored the dramatic changes in the amount and pattern of artificial light generated during the night and day in modern societies over recent decades. “The science underlying these hypotheses has a solid base,” they wrote, “and is currently moving forward rapidly.”

The connection between artificial light and sleep disorders is a fairly intuitive one. Difficulties with adjusting the circadian clock can lead to a number of sleep disorders, including shift-work sleep disorder, which affects people who rotate shifts or work at night, and delayed sleep-phase syndrome, in which people tend to fall asleep very late at night and have difficulty waking up in time for work, school, or social engagements.

The sleep pattern that was the norm before the invention of electric lights is no longer the norm in countries where artificial light extends the day. In the 2005 book *At Day's Close: Night in Times Past*, historian Roger Ekirch of Virginia Polytechnic Institute described how before the Industrial Age people slept in two 4-hour shifts (“first sleep” and “second sleep”) separated by a late-night period of quiet wakefulness.

Thomas A. Wehr, a psychiatrist at the National Institute of Mental Health, has studied whether humans would revert back

to the two-shift sleep pattern if they were not exposed to the longer photoperiod afforded by artificial lighting. In the June 1992 *Journal of Sleep Research*, Wehr reported his findings on eight healthy men, whose light/dark schedule was shifted from their customary 16 hours of light and 8 hours of dark to a schedule in which they were exposed to natural and electric light for 10 hours, then darkness for 14 hours to simulate natural durations of day and night in winter. The subjects did indeed revert to the two-shift pattern, sleeping in two sessions of about 4 hours each separated by 1–3 hours of quiet wakefulness.



Turtle hatchlings instinctively orient away from the dark silhouette of the nighttime shore. Here hatchlings have been temporarily distracted by a bright lamp. Hatchlings and mother turtles distracted by shorefront lights can wander onto nearby roadways.

Lynda Richardson/Corbis

Increase in Artificial Night Sky Brightness in North America



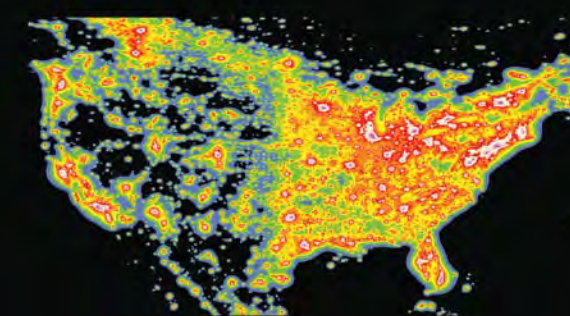
Late 1950s



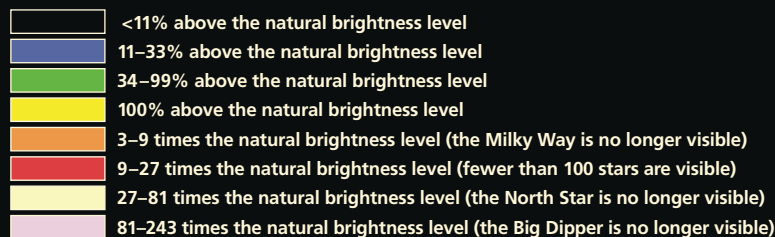
Mid 1970s



1997



2025



Artificial night sky brightness at zenith, at sea level, for a standard clean atmosphere as a fraction of the average natural night sky brightness. These maps are based on upward light measured by the Defense Meteorological Satellite Program after accounting for propagation and scattering of that light in the atmosphere. The 2025 map assumes a constant population growth rate of 6% per year.

Source: <http://www.lightpollution.it/> © 2001 P. Cinzano, F. Falchi, C.D. Elvidge

Beyond Sleep Disorders

Alteration of the circadian clock can branch into other effects besides sleep disorders. A team of Vanderbilt University researchers considered the possibility that constant artificial light exposure in neonatal intensive care units could impair the developing circadian rhythm of premature babies. In a study published in the August 2006 issue

of *Pediatric Research*, they exposed newborn mice (comparable in development to 13-week-old human fetuses) to constant artificial light for several weeks. The exposed mice were unable to maintain a coherent circadian cycle at age 3 weeks (comparable to a full-term human neonate). Mice exposed for an additional 4 weeks were unable to establish a regular activity cycle.

The researchers concluded that excessive artificial light exposure early in life might contribute to an increased risk of depression and other mood disorders in humans. Lead researcher Douglas McMahon notes, “All this is speculative at this time, but certainly the data would indicate that human infants benefit from the synchronizing effect of a normal light/dark cycle.”

Since 1995, studies in such journals as *Epidemiology*, *Cancer Causes and Control*, the *Journal of the National Cancer Institute*, and *Aviation Space Environmental Medicine*, among others, have examined female employees working a rotating night shift and found that an elevated breast cancer risk is associated with occupational exposure to artificial light at night. Mariana Figueiro, program director at the Lighting Research Center of Rensselaer Polytechnic Institute in Troy, New York, notes that permanent shift workers may be less likely to be disrupted by night work because their circadian rhythm can readjust to the night work as long as light/dark patterns are controlled.

In a study published in the 17 October 2001 *Journal of the National Cancer Institute*, Harvard University epidemiologist Eva S. Schernhammer and colleagues from Brigham and Women's Hospital in Boston used data from the 1988 Nurses' Health Study (NHS), which surveyed 121,701 registered female nurses on a range of health issues. Schernhammer and her colleagues found an association between breast cancer and shift work that was restricted to women who had worked 30 or more years on rotating night shifts (0.5% of the study population).

In another study of the NHS cohort, Schernhammer and colleagues also found elevated breast cancer risk associated with rotating night shift work. Discussing this finding in the January 2006 issue of *Epidemiology*, they wrote that shift work was associated with only a modest increased breast cancer risk among the women studied. The researchers further wrote, however, that their study's findings "in combination with the results of earlier work, reduce the likelihood that this association is due solely to chance."

Schernhammer and her colleagues have also used their NHS cohort to investigate the connection between artificial light, night work, and colorectal cancer. In the 4 June 2003 issue of the *Journal of the National Cancer Institute*, they reported that nurses who worked night shifts at least 3 times a month for 15 years or more had a 35%



The International Agency for Research on Cancer has classified shift work as a probable human carcinogen. A study in the December 2008 issue of *Sleep* found that use of light exposure therapy, sunglasses, and a strict sleep schedule may help night-shift workers achieve a better-balanced circadian rhythm.

increased risk of colorectal cancer. This is the first significant evidence so far linking night work and colorectal cancer, so it's too early to draw conclusions about a causal association. "There is even less evidence about colorectal cancer and the larger subject of light pollution," explains Stevens. "That does not mean there is no effect, but rather, there is not enough evidence to render a verdict at this time."

The research on the shift work/cancer relationship is not conclusive, but it was enough for the International Agency for Research on Cancer (IARC) to classify shift work as a probable human carcinogen in 2007. "The IARC didn't definitely call night shift work a carcinogen," Brainard says. "It's still too soon to go there, but there is enough evidence to raise the flag. That's why more research is still needed."

The Role of Melatonin

Brainard and a growing number of researchers believe that melatonin may be the key to understanding the shift work/breast cancer risk association. Melatonin, a hormone produced by the pineal gland, is secreted at night

and is known for helping to regulate the body's biologic clock. Melatonin triggers a host of biologic activities, possibly including a nocturnal reduction in the body's production of estrogen. The body produces melatonin at night, and melatonin levels drop precipitously in the presence of artificial or natural light. Numerous studies suggest that decreasing nocturnal melatonin production levels increases an individual's risk of developing cancer. [For more information on melatonin, see "Benefits of Sunlight: A Bright Spot for Human Health," *EHP* 116:A160–A167 (2008).]

One groundbreaking study published in the 1 December 2005 issue of *Cancer Research* implicated melatonin deficiency in what the report authors called a rational biologic explanation for the increased breast cancer risk in female night shift workers. The study involved female volunteers whose blood was collected under three different conditions: during daylight hours, during the night after 2 hours of

complete darkness, and during the night after exposure to 90 minutes of artificial light. The blood was injected into human breast tumors that were transplanted into rats. The tumors infused with melatonin-deficient blood collected after exposure to light during the night were found to grow at the same speed as those infused with daytime blood. The blood collected after exposure to darkness slowed tumor growth.

"We now know that light suppresses melatonin, but we are not saying it is the only risk factor," says first author David Blask, a research scientist at the Bassett Healthcare Research Institute in Cooperstown, New York. "But light is a risk factor that may explain [previously unexplainable phenomena]. So we need to seriously consider it."

The National Cancer Institute estimates that 1 in 8 women will be diagnosed with breast cancer at some time during her life. We can attribute only about half of all breast cancer cases to known risk factors, says Brainard. Meanwhile, he says, the breast cancer rate keeps climbing—incidence increased by more than 40% between 1973 and 1998, according to the Breast Cancer Fund—and

“we need to understand what’s going on as soon as possible.”

Linking Light Pollution to Human Health

The evidence that indoor artificial light at night influences human health is fairly strong, but how does this relate to light pollution? The work in this area has just begun, but two studies in Israel have yielded some intriguing findings. Stevens was part of a study team that used satellite photos to gauge the level of nighttime artificial light in 147 communities in Israel, then overlaid the photos with a map detailing the distribution of breast cancer cases. The results showed a statistically significant correlation between outdoor artificial light at night and breast cancer, even when controlling for population density, affluence, and air pollution. Women living in neighborhoods where it was bright enough to read a book outside at midnight had a 73% higher risk of developing breast cancer than those residing in areas with the least outdoor artificial lighting. However, lung cancer risk was not affected. The findings appeared in the January 2008 issue of *Chronobiology International*.

“It may turn out that artificial light exposure at night increases risk, but not entirely by the melatonin mechanism, so we need to do more studies of ‘clock’ genes—nine have so far been identified—and light exposure in rodent models and humans,” Stevens says. Clock genes carry the genetic instructions to produce protein products that control circadian rhythm. Research needs to be done not

just on the light pollution–cancer connection but also on several other diseases that may be influenced by light and dark.

Travis Longcore, co-editor of *Ecological Consequences of Artificial Night Lighting* and a research associate professor at the University of Southern California Center for Sustainable Cities, suggests two ways outdoor light pollution may contribute to artificial light–associated health effects in humans. “From a human health perspective, it seems that we are concerned with whatever increases artificial light exposure indoors at night,” he says. “The effect of outdoor lighting on indoor exposure could be either direct or indirect. In the direct impact scenario, the artificial light from outside reaches people inside at night at levels that affect production of hormones. In an indirect impact it would disturb people inside, who then turn on lights and expose themselves to more light.”

“The public needs to know about the factors causing [light pollution], but research is not going at the pace it should,” Blask says. Susan Golden, distinguished professor at the Center for Research on Biological Clocks of Texas A&M University in College Station, Texas, agrees. She says, “Light pollution is still way down the list of important environmental issues needing study. That’s why it’s so hard to get funds to research the issue.”

“The policy implications of unnecessary light at night are enormous,” says Stevens in reference to the health and energy ramifications [for more on the energy impact of light pollution, see “Switch On the Night: Policies for Smarter Lighting,” p. A28 this issue]. “It is fully as important an issue as

global warming.” Moreover, he says, artificial light is a ubiquitous environmental agent. “Almost everyone in modern society uses electric light to reduce the natural daily dark period by extending light into the evening or before sunrise in the morning,” he says. “On that basis, we are all exposed to electric light at night, whereas before electricity, and still in much of the developing world, people get twelve hours of dark whether they are asleep or not.”

Sources believe that the meeting at the NIEHS in September 2006 was a promising beginning for moving forward on the light pollution issue. “Ten years ago, scientists thought something was there, but couldn’t put a finger on it,” says Leslie Reinlib, a program director at the NIEHS who helped organize the meeting. “Now we are really just at the tip of the iceberg, but we do have something that’s scientific and can be measured.”

The 23 participants at the NIEHS-sponsored meeting identified a research agenda for further study that included the functioning of the circadian clock, epidemiologic studies to define the artificial light exposure/disease relationship, the role of melatonin in artificial light–induced disease, and development of interventions and treatments to reduce the impact of light pollution on disease. “It was a very significant meeting,” Brainard says. “It’s the first time the National Institutes of Health sponsored a broad multidisciplinary look at the light–environmental question with the intent of moving to the next step.”

Ron Chepesiuk

TAB HH

Oil Drilling in Los Angeles

A Story of Unequal Protections

Introduction

The land of sunshine, celebrities, and world-famous beaches is also home to 5,000 active oil and gas wells.ⁱ These wells are spread across 10 oil fields and 70 different sites embedded in neighborhoods, parks, and commercial districts throughout Los Angeles City.ⁱⁱ More broadly, 1 in 3 Los Angeles County residents live within one mile of an oil drilling site; more than half a million live within a quarter-mile.ⁱⁱⁱ For those living in close proximity, oil and gas production is not only disruptive with noisy equipment, truck traffic, and unattractive rigs, but also potentially harmful with dangerous air pollution and the use of large amounts of toxic chemicals. Though science and impacted communities have long documented these health and quality of life threats, the City of Los Angeles has never conducted a full environmental review of the potential risks and necessary safeguards.

Despite these risks, oil and gas production in Los Angeles is expected to continue into the foreseeable future. The number of active wells has increased by 16% over the last 10 years, and the Los Angeles Basin may have another 5 billion barrels of recoverable oil.^{iv} This expected trend is disconcerting because although oil drilling has occurred in LA for over a century, regulatory loopholes and gaps have allowed health and welfare issues to arise in surrounding neighborhoods. Some oil-related pollution is exempt from key laws like the Clean Air Act and Safe Drinking Water Act while locally the Los Angeles Department of City Planning recently reported city regulations have failed to adapt to the changing nature of oil production and the urban environment in which drilling occurs.^v As result, communities are placed at risk whenever drilling and oil extraction occurs near their homes and schools. The nature of oil extraction is also changing - further fueling concern about the impacts to surrounding neighborhoods. Technologies like hydraulic fracturing and acid treatments have been around for decades but their frequency and intensity of use has increased.^{vi} As the nature of acid treatments and hydraulic fracturing changes, the potential risks also change. With oil production continuing and technology rapidly evolving, it's important for decision-makers, issue-stakeholders, and the general public to understand where and how oil drilling is occurring and to assess whether Los Angeles City neighborhoods are equally protected from oil drilling risks.

Contents

Introduction	1
Background	2
L.A. City Wells - 380 Feet From Our Homes & Schools	2
Comparing Drilling Across Disparate Communities	3
Community Protections	9
Complaints & Violations	15
Conclusion	16

Background

With easily accessible petroleum disappearing, companies are turning to well stimulation treatments and unconventional extraction to tap into more challenging oil and gas reserves. Until recently, oil and gas came from underground pools that would send fluid upward once drilled into.^{vii} This is known as conventional oil production. After decades of drawing from these conventional sources, the number of large pockets of petroleum sources has shrunk. New technologies, however, have allowed oil companies to access “unconventional” petroleum resources that were previously inaccessible. These unconventional petroleum resources are very small pockets of oil and gas that are trapped between or attached to sand or rock. The low permeability of the underground formation prevents the petroleum from easily flowing to the surface through a well.^{viii} Acidization and hydraulic fracturing are well stimulation treatments that increase the amount of petroleum flowing to the surface.^{ix} With acidization, acids and other fluids dissolve the sediment in the underground formation. Small bubbles of oil then break away from rock and flow upward into the well.^x Acid is also used to maintain or clean out a well. In California there is a debate about the distinction between an acid maintenance activity and acidization treatment that increases the underground formation’s permeability. Because both activities involve large amounts of hazardous chemicals, increase petroleum production, and present a risk to communities’ health and safety, they are classified as acid treatments in this paper. Hydraulic fracturing, also known as fracking, involves pumping large volumes of water and chemicals into the ground at high pressure to cause fractures in the underground geological formations. Gravel packing is another well stimulation activity that involves placing a liner wrapped in gravel in the well to keep sand from the underground formation out of the wellbore.^{xi} Well stimulation occurs in Los Angeles County and its use allows companies to continue operations at wells that may otherwise be facing the end of their productive life cycle.¹ Though present day discourse often focuses on the risks associated with well stimulation activities, all oil and gas activities present a public health risk when occurring without adequate safeguards such as a large separation between oil production and sensitive populations and emissions control measures.

L.A. City Wells - 380 Feet From Our Homes & Schools

Citywide there are at least 17 sites with wells dangerously close to homes, schools, and other sensitive population centers.² A new South Coast Air Quality Management District rule requires companies to report activities like drilling new wells, using acid to clean out wells, or using chemicals to increase oil production. The new rule, 1148.2, also requires companies to determine whether these activities are within 1,500 feet of sensitive populations such as a school or home. Because of 1148.2, we know approximately **86 wells were drilled, acidized, gravel packed, or underwent a related measure within 1,500 feet of a vulnerable population center like a school, home, or daycare center** between June 2013 and September 2014. Of the 17 sites with wells within 1,500 feet of a sensitive population, the **average separation was only 380 feet**.

Petroleum air toxics pose a significant risk when within 1,000 feet of people and oil-related smells can permeate the air for up to 3,000 feet.^{xii} Not only are there 86 instances of oil-related activities occurring hazardously close to homes and schools in Los Angeles, but air quality rules also fail to adequately protect against potential hazards. When creating rule 1148.2, the Air Quality Management District

¹ Using Air Quality Management District’s Rule 1148.2 definition of a well production stimulation activity.

² Based on the Air Quality Management District’s Rule 1148.2 staff report, wells within 1,500 feet of sensitive population centers like homes, schools, and daycare centers present a health risk and may release detectable odors.

reported regulatory gaps with controlling emissions from oil drilling, well completion, and well reworking activities with particulate matter, hydrocarbons, and toxic emissions potentially posing a risk to surrounding communities.^{xiii} Drilling occurs across the city, as the map below shows, yet local regulations are not protecting against a range of risks.



Source: Division of Oil Gas & Geothermal Resources

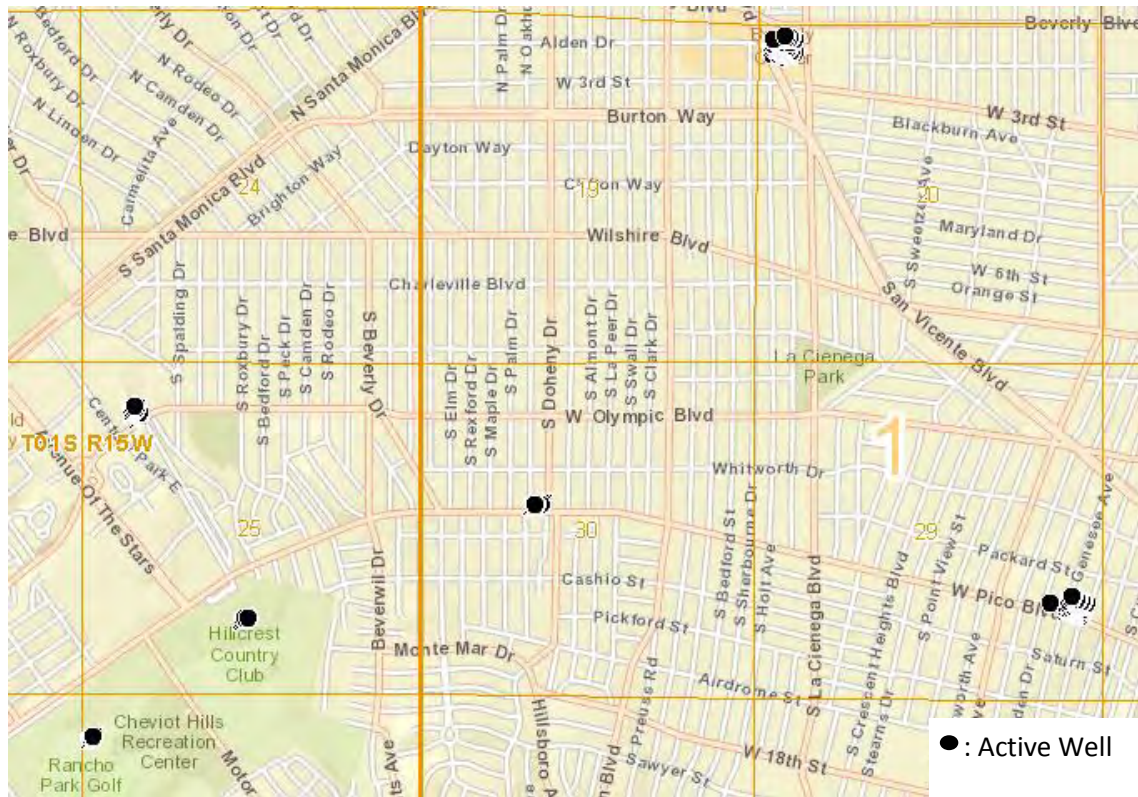
Comparing Drilling Across Disparate Communities

Although oil drilling occurs in diverse neighborhoods ranging from affluent Cheviot Hills to pollution-burdened Wilmington, not all communities are equally protected from the risks associated with oil production. To determine whether disparities in treatment exists, we compared oil drilling intensity (i.e. number of wells), type of well stimulation activities (i.e. acidization), violations of rules, and average separation of sites from sensitive uses in oil drilling sites across South Los Angeles, Wilmington, and Harbor City in contrast to sites in the Wilshire and West Los Angeles Community Plan Areas. We looked at all four active sites in the Wilshire and West LA Community Plan areas, all three active sites in South LA,³ and three randomly selected sites in the Wilmington and Harbor City areas. The West LA and

³ Two sites, Jefferson and Murphy, are currently producing. The third site in University Park and operated by Allenco Energy Corporation (Allenco) is not currently operating. It voluntarily shut down in November 2013 due to community concerns and remains shut down until U.S. Environmental Protection Agency mandated upgrades are completed. Allenco is currently implementing the mandated equipment updates.

Wilshire sites (pictured below) have a median household income of \$78,700 compared to the South Los Angeles and Wilmington/Harbor City site areas' median income of \$33,000.⁴

West LA & Wilshire Community Plan Oil Drilling Sites⁵



Source: Division of Oil Gas & Geothermal Resources

Over 90% of the residents in the South Los Angeles and Wilmington site neighborhoods, pictured below, are people of color while the West LA and Wilshire sites are located in neighborhoods that are 69% white.

⁴ Compared income and racial composition at the census tract level.

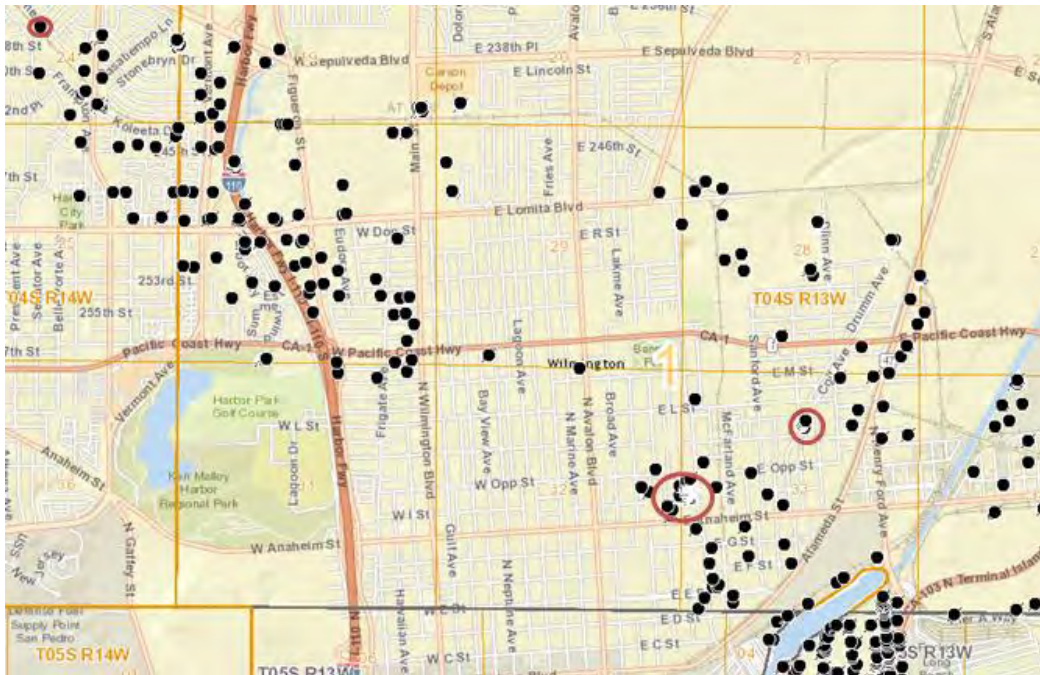
⁵ The site on Olympic was not examined because it is in Beverly Hills rather than the city of Los Angeles. The two groupings of rigs in the Hillcrest Country Club and Rancho Park Golf Club were considered one site because that was how the Planning Department classified the site.

South Los Angeles Oil Drilling Sites⁶



Source: Division of Oil Gas & Geothermal Resources

Wilmington and Harbor City Sites⁷



Source: Division of Oil Gas & Geothermal Resources

⁶ The site on Washington was not examined because it has not produced oil since 2010.

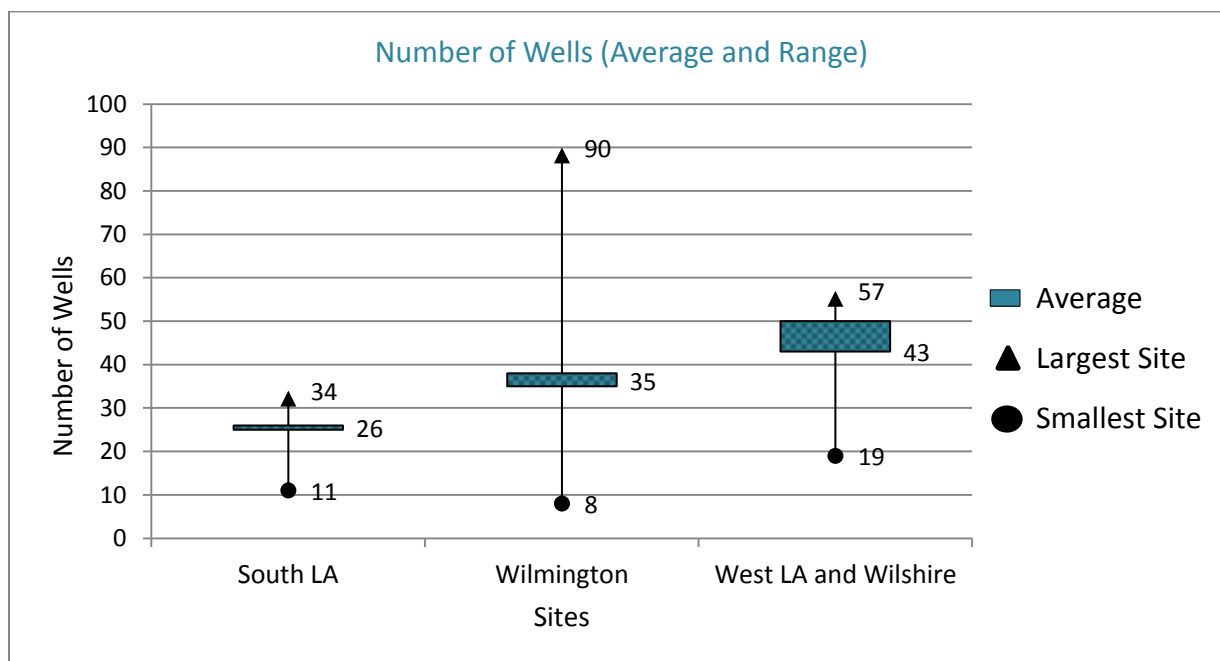
⁷ Sites examined circled in red.

Oil Production Intensity

The size of operations at a site is one dimension of potential risk. A larger site may handle more oil, use more toxic chemicals, or run more polluting equipment like drilling rigs or diesel trucks. Furthermore, an AQMD report identified three potential sources of pollution that are inadequately regulated by AQMD rules: emissions of drilling fluids pumped into the ground, fluids flowing back to the surface during the production process, and pollution coming from equipment run during drilling and well treatments (i.e. acidization).^{xiv} The number of wells and the frequency and type of oil activities (i.e. frequency of drilling or acidizing) are used as an approximate estimate of how intense oil production is at a site.

Number of Wells

As the *Number of Wells* table shows, the West LA and Wilshire sites have on average 17 more wells than South LA sites and 8 more wells than Wilmington sites. The largest site overall, however, is in Wilmington with 90 wells.



Frequency of Drilling and Other Well Treatments

The type and frequency of activities occurring at a site is another dimension of potential risk. The South Coast Air Quality Management District found Los Angeles-area companies use at least 13 air toxic chemicals when drilling, acidizing, gravel packing, and hydraulic fracturing. Well stimulation treatments use tens of thousands of pounds of toxic substances like silica, hydrofluoric acid, and hydrochloric acid (on average, acidization uses 11,000 pounds and hydraulic fracturing uses over 88,000 pounds) that pose a health threat if individuals are exposed.^{xv}

Amounts of Key Air Toxics Used in Well Activities⁸

	Drilling	Acidizing	Gravel Packing	Hydraulic Fracturing
Number of Events	177	254	155	14
Air Toxic	Average Use per Activity (lb)	Average Use per Activity (lb)	Average Use per Activity (lb)	Average Use per Activity (lb)
Crystalline Silica	1,943	7,240	42,883	86,947
Ethylbenzene	Not Used	209	Not Used	Not Used
Ethylene Glycol	.2	2.2	19	74
Formaldehyde	.2	<0.05	.2	Not Used
Glutaral	212	Not Used	221	Not Used
Hydrochloric Acid	Not Used	3,461	Not Used	Not Used
Hydrofluoric Acid	Not Used	411	197	
Methanol	2	80	14	1,003
Naphthalene	.2	1	.1	Not Used
Phosphoric Acid	125	Not Used	Not Used	Not Used
Sodium Hydroxide	Not Used	.05	21	58
Toluene	Not Used	27	Not Used	Not Used
Xylene	Not Used	109	Not Used	Not Used

The public may not only be exposed to air toxic chemicals, but also breathe harmful pollutants including nitrous oxide, particulate matter, and organic compounds that are released during drilling, acidization, gravel packing, and hydraulic fracturing. These compounds can cause cancer, respiratory issues, and cause damage to kidneys, the nervous system, the liver, brain, and heart.^{xvi} Furthermore, the Los Angeles Basin in general has unsafe levels of particulate matter and ozone (a byproduct of nitrous oxide reactions),⁹ so any additional releases add to the potential harm towards immediate communities. When taking air samples at a subset of recent rule 1148.2 activities, the Air Quality Management District found drilling, for example, releases over 7 pounds of nitrous oxide and nearly 4 pounds of particulate matter per day while also increasing concentrations of dangerous compounds including hydrocarbons.^{xvii} Acidization, gravel packing, and hydraulic fracturing all also released multiple harmful pollutants. With particulate matter and ozone traveling a hundred miles or more, oil and gas emissions have the potential to harm surrounding communities.^{xviii}

⁸ Based on the South Coast Air Quality Management District's Rule 1148.2 disclosure rule. This report only measured non-trade secret information. "Not used" is based on whether that chemical was disclosed in the chemical report.

⁹ Los Angeles exceeds the Clean Air Act's designated safe emissions levels for particulate matter and ozone.

Estimates of Average Emissions per Type of Activity^{10,xix}
June 2013 – June 2014

Well Activity	Nitrous Oxide (lbs/day)	Particulate Matter (lbs/day)	Organic Compounds Detected
Drilling	7.5	3.8	Increase in Alkanes & Hydrocarbons
Acidizing	.5	.4	Increase in Hydrocarbons
Gravel Packing	1.6	5	Mostly static
Hydraulic Fracturing	8.4	.6	Increase in Alkanes & Hydrocarbons

Well Activities Results

There are significant differences in activities across the sites. Expansion is occurring most rapidly in Wilmington with one site drilling 22 new wells in 15 months. One well was drilled in South LA and none in the West LA and Wilshire areas.

In terms of well stimulations, the West LA and Wilshire sites averaged around 4 well stimulations per site while the South LA and Wilmington sites averaged 2 stimulations per site. There were no hydraulic fracturing events at the sites studied. One West LA site alone accounted for 10 acidizations, and if removed, the other West LA and Wilshire sites would average around 2 stimulations per site. Wilmington was the only place where gravel packing was used and it was done six times. It also involved large quantities of silica, which when sufficiently small and inhaled, can lead to sometimes terminal lung diseases like lung cancer and silicosis.^{xx}

Total Number of Well Activities in Each Area
June 2013 – October 2014

	Wells Drilled	Total Well Stimulations (acidization, gravel packing, etc)	Acidizing (including acid maintenance)	Fracturing
South LA	1	6	6	0
Wilmington	22	6	0	0
Wilshire & West LA CPs	0	17	17	0

¹⁰ Nitrous oxide and particulate matter emission estimations based on equipment information such as engine tier and hours of operation. Organic compounds and hydrogen sulfide based on random, limited air sampling done during those activities.

Community Protections

Regardless of whether acidization occurs or wells are newly drilled, a community's health and welfare may be at risk wherever oil and gas is produced near people's homes and schools. As described above, oil has hazardous emissions like carcinogenic benzene and drilling can also create noxious disruptions like smells, noise from pipes clanking, or vibrations from trucks driving into the site. The University Park neighborhood living across the street from the AllenCo operations experienced this first hand. Data from 2013 suggests AllenCo only used conventional oil production techniques, yet for years residents were reporting unusual health symptoms like headaches and nosebleeds. Faulty equipment leaking emissions up to 1,200 times the legal limit seemed to have been the issue. A site's proximity to homes, use of protective barriers, and adherence to rules may minimize or amplify the risk of allowing oil production in a dense urban environment.

Oil Well Proximity

South LA and Wilmington sites are on average 260 to 315 feet closer to sensitive uses than oil sites in the West LA and Wilshire areas. In many cases, oil is being produced within 140 feet of homes, schools, health care facilities, and parks. At the West LA and Wilshire sites, there are two types of structures – outdoors and completely/partially enclosed structures. The outdoor sites are an average of 570 feet from homes. The enclosed sites, either entirely within a building or rigs and trucks enclosed, are on average 150 feet away from homes.

Average Distance to Closest Sensitive Use	
South LA	85 feet
Wilmington	139 feet
West LA and Wilshire	400 feet
West LA Indoor Sites	150 feet
West LA Outdoor Sites	570 feet

This distance measures the separation between a sensitive use and wells, but other hazardous activities occur even closer to residents' homes. As the picture of the Jefferson site shows, large amounts of chemicals are stored and handled very near a home.

Jefferson during an "Acid Maintenance" Job



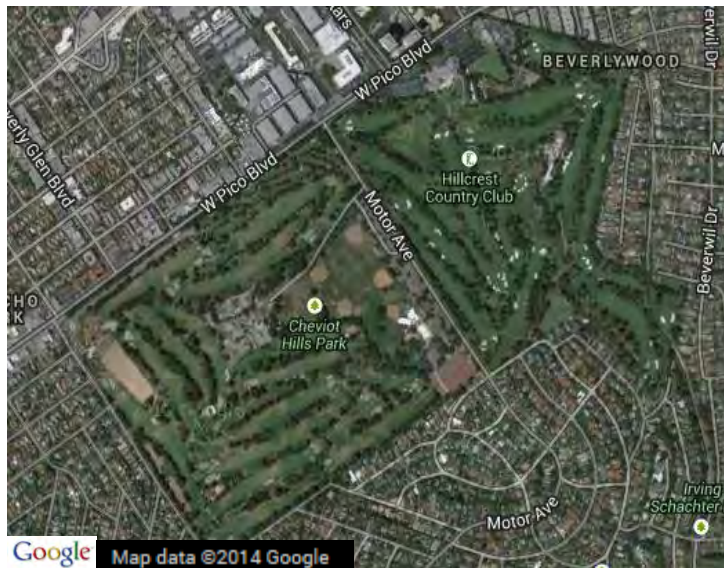
Photo Credit: Richard Parks

Site Profiles

Community protections, or the lack thereof, vary on a site by site basis. Each site profile below describes the features and precautions that either enhance or undermine protections to the surrounding neighborhood's wellbeing. The West LA and Wilshire sites have a variety of design features and operation restrictions, many imposed by a Zoning Administrator, that protect the surrounding communities to a greater degree than the South LA and Wilmington sites.

Cheviot Hills Sites (West LA Community Plan Area)

The Hillcrest Country Club and the Cheviot Hills Recreation Center house two oil drilling sites in the Cheviot Hills community. The Hillcrest site is 700 feet from homes and housed on a 138 acre property.



The Cheviot Hills Recreation Center site is surrounded by 200 acres.^{xxi} The Recreation Center and Country Club grounds create a naturally large buffer between residences and operations. The buffer and trees also screen the machinery. When a Planning Department Zoning Administrator first created drilling conditions in 1957 for the Hillcrest Site, the administrator noted the sites are **“near the quality residential neighborhood known as Cheviot Hills... so all features of oil drilling and production must be strictly controlled to eliminate any possible odor, noise, hazards, unsightliness, or extensive truck traffic.”** The Zoning Administrator noted a

potential visual impact and required the operator to use a shorter drilling derrick that was to blend in with the surrounding trees and landscaping using expertly designed camouflage. The Zoning Administrator's conditions were appealed by residents in 1957, and the Board of Zoning Appeals required the drilling derrick be better screened by transplanting taller trees (at least 60 feet) around the equipment and placing equipment at lower elevation than was previously required. One acidization has occurred here.

Packard Site (Wilshire Community Plan Area)

The Zoning Administrator and City Council has placed design features and operation restrictions on the Wilshire site to protect the neighboring residents. In 2002, the Los Angeles City Council passed a motion restricting the hours of operations for non-drilling activities to the hours of 7 am to 7 pm just for the Packard site. The Zoning Administrator also required the operator post a 24 hour hotline number on the building walls and use electric equipment, rather than diesel, to reduce noise and pollution.



The non-descript building enclosing the Packard Site oil activity is perhaps the most striking and unique feature of this 1.5 acre site. Aside from signs listing a hotline phone number and warning of dangerous chemicals, a passer-by would not know what is right behind the multistory walls. The building was required in 1966 when the Zoning Administrator first created terms and conditions for drilling in this neighborhood. The Zoning Administrator indicated the dense residential community was not appropriate for drilling stating **“due to the intensive nature and quality of the adjacent residential development, the subject site is certainly not the most appropriate for a controlled drilling site such as those previously approved in industrial zones or a large open area such as a golf course.”** Because the Zoning Administrator could not find a more appropriate, safer site, drilling was permitted as long as rigorous precautions were taken including constructing an expensive building to house the site. As the administrator said, **“in recognition ...of the proximity of the site to the quality district in which located and at considerable increased expense, [the operators] have had designed a most attractive soundproofed building for construction on the site** which would not only house a drilling rig and drilling equipment but the loading and unloading operations of pipe and supplies needed in connection there, as well as the future portable equipment needed in servicing the wells on occasion after completed. [emphasis added]” It appears oil operations were considered by city officials to be incompatible with residential areas even in the 1960s. Interestingly, this precaution was not applied to other active oil sites in residential centers like South LA. There are around 55 active wells and five acid maintenance-related activities occurred at the Packard site between June 2013 and September 2014.

San Vicente Drill Site (Wilshire Community Plan Area)

This 1.5 acre site is tucked behind the Beverly Center Shopping Center and is across the street from Cedars Sinai Hospital. It is around 200 feet from the hospital and approximately 500 feet from the nearest residence. This site lacks the protective features provided to the Packard site likely in part because the Zoning Administrator determined residences were hundreds of feet away and the immediate area was used for commercial or industrial purposes when the Administrator designated the property a controlled drill site.^{xxii}

New restrictions were added to operations in an August 2014 Zoning Administrator case (ZA 19139 (PA 10)) where the operator requested to re-drill three wells. New conditions include providing a 24 hour hotline with the number posted on the premise’s exterior walls, requiring complaints and concerns be addressed within a 24 hour window, prohibiting hydraulic fracturing or acid well stimulation treatments, and allowing the Zoning Administrator to impose additional corrective conditions if the Administrator considers it necessary to protect the



neighborhood. This was the only City Planning file reviewed that directly addressed well stimulation treatments. There are around 57 active wells on the site and 10 acidization or maintenance activities occurred here since implementation of AQMD’s 1148.2 rule.

Doheny Site (West LA)

The 0.76 acres site is immediately adjacent to homes that are 190 feet away. Conditions originally imposed by the Zoning Administrator, coupled with community member and council member engagement, an environmental impact review process, and a lawsuit, have created some of the strongest restrictions on an LA City site. The 1965 **Zoning Administrator case that initially authorized drilling conditions required the drilling derrick be fully enclosed in a sound proofed structure that was painted blue to blend with the sky.**

The Zoning Administrator stated the derrick enclosure measure was taken “to integrate the development into the well developed residential section to the north.” Drilling derricks can be a significant source of pollution, noise, and unsightly equipment and this condition sought to reduce those impacts. The operator was also required to maintain a portion of the site bordering homes as a buffer between oil operations and homes with only landscaping treatment and employee parking. The derrick enclosure was removed in the mid-1980s.



In the late 1990s, the oil company wanted to overturn a previous condition that allowed use of a temporary diesel rig that could only be operated 10 days a month. The company proposed switching to a permanent rig. To offset the impacts of more constant drilling, the oil company offered some compromises. They would switch from a diesel rig to an electric one which is quieter and releases considerably fewer air toxics. The company also raised the surrounding walls from a height of 12 feet to 25. Finally, the drilling derrick was again enclosed and much of the operations, including truck deliveries, were moved indoors.

An environmental impact report was done on this proposal. Restrictions on oil production came from the environmental review process and a related lawsuit settlement, which include the following conditions:

- Weekly odor monitoring for a two year period with reports sent to the Zoning Administrator and the operator required to make corrections to any issues.
- Noise levels are capped.
- Continuous noise monitoring equipment and video system with noise reports sent to the Zoning Administrator monthly. When site exceeds the permissible noise level, the video system was reviewed to determine what activity caused the problem.
- Methane and hydrogen sulfide early detection system with notifications sent to the Los Angeles County Fire Department.
- Tests for other air emissions done weekly.
- Designated community liaison available 24 hours a day with number posted on signs.

- Vehicles enter and exit off main neighboring street and must turn engines off immediately after entering or shortly before exiting. Vehicles cannot rev their engines.
- Potential fumes are vented up through top of the derrick enclosure which may reduce odors by a factor of 1,000.

There are 43 active wells on the site and one acid-related activity occurred here recently.

South LA and Wilmington Sites

In the Wilshire and West LA area, all of the sites are either relatively far from homes or, if they are near homes, the operations are partially or completely enclosed. While rendering their decisions for the Wilshire and West LA areas, Zoning Administrators uncharacteristically noted the adjacent “quality” residences and enacted requirements that protected these homes. As we mentioned above, these Zoning Administrators were not shy about their opinion that oil drilling was an activity that was more suited for industrial zones, and only allowed drilling in Wilshire and West LA after a strict set of precautionary measures were enacted.

South LA and Wilmington Sites, however, not only have far fewer protections, but are closer to sensitive populations. And in some cases, what protections were in place have weakened over time. Four of six Wilmington and South LA sites are examined below.

Jefferson Site (South LA Community Plan)

With wells only 60 feet from homes, the Jefferson drill site is closer to sensitive sites than any other LA City oil drilling site.^{xxiii} Homes are immediately adjacent to and across the street from the 1.86 acre site.



Unlike the Doheny site where protections increased over time, **the Jefferson neighborhood has seen protections weakened and suggested restrictions abandoned.** The Zoning Administrator’s 1965 decision noted the site’s proximity to a densely developed residential neighborhood and stated oil operations must be strictly controlled to protect people living in close proximity. The oil company agreed to maintain

two immediately adjoining lots to provide a buffer between oil production and residential development on the same block as operations. The Planning Department has since removed the buffer requirement.

The Zoning Administrator also believed all undesirable features of oil drilling could be mitigated except disguising the aesthetically unattractive oil rig. The administrator recommended future administrators consider covering equipment with a “permanent type of attractive soundproof enclosing fixture giving the derrick more the appearance of a monument.” In 1971, the Zoning Administrator reserved the right to order enclosed drilling machinery if noise from operations bothered surrounding residents. Despite

present day issues with noise, the Zoning Administrator has not exercised that right. The rig remains unenclosed. The site houses 34 active wells and four acid related jobs occurred here between June 2013 and September 2014.

Murphy Drill Site (South LA Community Plan)

Drilling at the Murphy Drill site occurs less than 100 feet from a clinic for HIV patients and within a couple hundred feet of apartments and senior citizen housing. As with West LA sites, the Zoning



*Photo Credit: flickr user facesoffracking
licensed under CC BY-NC-ND 2.0*

Administrator originally prescribing conditions for drilling in 1961 noted the site's proximity to "quality" residential improvements and prescribed mitigations such as soundproofing equipment and camouflaging the drilling derrick. The Administrator determined the site's unattractive equipment would be an objectionable impact, but as seen in the Jefferson site, a "more rigid permanent type of attractive soundproof enclosing fixture" resembling a monument for the drilling rig was recommended but does not exist. In 2006, the area's neighborhood council requested protections seen at the Doheny site such as noise and emission monitoring and a 24-hour

attended phone number, but the Zoning Administrator did not grant the request.¹¹ The Murphy site has around 34 wells and two acid-related activities occurred in 2014.

AllenCo site in University Park (South LA Community Plan)

The site's oil company, AllenCo, produces oil approximately 100 feet from a multi-unit residential housing development, a high school for developmentally disabled youth, and borders Mount St. Mary's College. In January 2014, the U.S. Environmental Protection Agency (EPA) charged AllenCo with discharging hazardous substances, failing to keep operations safe and putting residents' health and safety at risk.^{xxiv} Around the same time, Los Angeles City Attorney filed a suit against AllenCo for refusing to repair many defects and ignoring regulatory standards. From 2010 to its temporary shutdown in 2013, the site likely caused acute health symptoms like headaches, nosebleeds, nausea, and respiratory ailments. Due in part to education by the *People Not Pozos Campaign*, community members filed complaints for three years before U.S. Senator Barbara Boxer noted the community's concerns and requested an EPA investigation. On a short investigative site visit, EPA investigators became ill with sore throats, headaches, and coughing. The agency levied a \$99,000 fine and required AllenCo implement \$700,000 in equipment upgrades.^{xxv} Although residents' health symptoms diminished once AllenCo temporarily halted productions in 2013, occasional odors continue to burden the community and the company plans on resuming oil production once the equipment is updated. Based on reports to the Air Quality Management District and public statements, it appears no unconventional extraction such as acidization occurred at the site and conventional production and associated fumes caused the health issues. There were 11 active wells when the site was in production in 2013.

¹¹ Zoning Administrator Case 15227(O)(PA3) for terms and conditions for redrilling three wells.

Warren E & P Site (Wilmington Community Plan)

With 90 active wells, the site operated by Warren Energy & Power is the largest case study site examined. In 2006, the operator proposed a 540 well drilling project at a site in which 9 wells had previously existed. Despite the huge increase, the City required only a limited review of the potential impacts of the project and **refused to conduct a complete environmental review process before allowing the additional wells.**^{12xxvi} Organizing and community outreach by Communities for a Better Environment uncovered broad dissatisfaction over the site's disruptive operations. As of their 2009 report, CBE found that the neighborhood was kept awake at night due to noise, dust made breathing difficult, trucks were often in the residential streets, and gas was frequently burned off in "flares" that were operated contrary to the Air Quality Management District's rules.¹³ Residents expressed irritation and concern about noxious smells, loud noises both day and night, and the many other problems resulting from this operation. During a community survey, people referred to their experience of living next to Warren E & P during construction and operation as "a living hell".^{xxvii} This site is expanding rapidly with 22 wells drilled between June 2013 and September 2014 and another 6 wells undergoing gravel packing.

Other Wilmington and Harbor City Sites

Oil production is widespread in the Wilmington and Harbor city areas. Two other sites in Wilmington and Harbor City were also randomly selected and reviewed. One each site sits 8 wells within 150 feet of a home. Although these were the smallest sites studied, they still produced 12,000 to 25,000 barrels of oil in 2013. Well stimulation treatments were not used at these sites.

Wilmington Site



Harbor City Site



Complaints & Violations

Many regulations are designed to protect the public's health, and violations may mean that a surrounding neighborhood was put at risk. A violation may also indicate a company is unable or indifferent to protecting the surrounding community. Complaints can also further illustrate the public's awareness and dissatisfaction with a site's operations.

¹² The City only required the limited analysis required by a California Environmental Quality Act project designation of "negative declaration".

¹³ A profile on the site by Communities for a Better Environment in the report "Cumulative Impacts: Changing Regulatory Culture to Address Environmental Injustice & Environmental Racism".

Comparing the violations and complaints for the sites operating in South LA and Wilmington to those in wealthier, whiter neighborhoods, there is a significant difference. South LA site had 41 more violations and 300 more complaints than their West LA counterparts. Twenty-seven violations were issued for the AllenCo site, 8 at the Jefferson site, and 7 at the Murphy site. In comparison to the AllenCo site, the operations at Murphy and Jefferson have far fewer violations. However, when compared to the violations in West LA, the sites have 7 and 8 times as many, respectively.

The number of violations in and of itself is startling, but the nature of the violations raises additional concerns. Violations include improper flaring (Warren E&P), vapor leaks greater than the legal limit of 500 parts per million (Jefferson, Murphy, AllenCo), and volatile organic compound leaks 100, 200, and 1,200 times greater than the legal limit (AllenCo). The AllenCo site case study provides a sense of how detrimental operation failures can be to a surrounding community's health.

Complaints and Violations Between 2007 - 2012

	Division of Oil Gas & Geothermal Resources		Air Quality Management District		LA City Dept. of Building & Safety
	Complaints	Violations	Complaints	Violations & Notice to Comply	Violations
South LA	1	5	333	35	3
Wilmington	0	0	9	13	0
West LA and Wilshire	0	1	1	2	0

Conclusion

Whenever oil and gas is produced near homes, schools, daycare centers, and other sensitive population centers, residents are put at risk. With 17 sites across the City of Los Angeles operating hazardously close (within 1,500 feet) to these kinds of sensitive population centers, oil and gas operations present a significant citywide risk to public health that decision-makers have failed to effectively address. Although oil and gas production occurs citywide, the relative risk is significantly higher in lower-income communities of color. Oil drilling occurs closer to homes, has fewer protective features such as air monitoring and enclosed operations, and is subject to more regulatory violations and complaints. By swiftly implementing citywide standards fully protective of human health, Los Angeles can not only correct this environmental injustice but also ensure that all Angelenos are protected from oil and gas operations.

ⁱ 5,000 wells in LA County. 3,750 producing oil and gas wells in 2013 according to [ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2013/2013%20County%20Production.pdf](http://ftp.consrv.ca.gov/pub/oil/annual_reports/2013/2013%20County%20Production.pdf) and 1,480 injecting wells as of 2009 according to [ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2009/PR06_Annual_2009.pdf](http://ftp.consrv.ca.gov/pub/oil/annual_reports/2009/PR06_Annual_2009.pdf)

ⁱⁱ Number of oil fields: Gamache, M., & Frost, P. (2003). *Urban Development of Oil Fields in the Los Angeles Basin Area, 1983-2001* (No. Publication No. TR52). Division of Oil, Gas, and Geothermal Resources: California Department of Conservation. Retrieved from <ftp://ftp.consrv.ca.gov/pub/oil/publications/tr52.pdf>

Number of Active Oil Production Sites: Reviewed Division of Oil Gas and Geothermal Resources Well Finder Map available at <http://conservation.ca.gov/dog/Pages/Wellfinder.aspx>

ⁱⁱⁱ Woody, T. (2014, October 22). 1 out of 3 People in Los Angeles Lives Within a Mile of an Oil Well. Retrieved from <http://www.takepart.com/article/2014/10/21/55-million-californians-live-within-mile-oil-and-gas-well>; Srebotnjak, T., & Rotkin-Ellman, M. (2014). *Drilling in California: Who's at risk?*. Natural Resources Defense Council & Coalition for Clean Air. Retrieved from <http://www.nrdc.org/health/files/california-fracking-risks-report.pdf>

^{iv} Calculated oil and gas production and injection wells on a county basis by reviewing the annual reports. 2013 annual report: [ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2013/2013%20County%20Production.pdf](http://ftp.consrv.ca.gov/pub/oil/annual_reports/2013/2013%20County%20Production.pdf), 2003 annual report [ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2003/PR06_Annual_2003.pdf](http://ftp.consrv.ca.gov/pub/oil/annual_reports/2003/PR06_Annual_2003.pdf); estimated injection wells based on historic injection well trends

Gautier, D.L., Tennyson, M.E., Cook, T.A., Charpentier, R.R., and Klett, T.R., 2012, revised 2013, Remaining recoverable petroleum in ten giant oil fields of the Los Angeles Basin, southern California: U.S. Geological Survey Fact Sheet 2012-3120, v. 1.1, 2 p. (Available at <http://pubs.usgs.gov/fs/2012/3120/>.)

^v *Summary of Federal Regulations and Regulatory Gaps*. (2012). The Network for Public Health Law. Retrieved from https://www.networkforphl.org/_asset/mxvqpc/Federal-Regulation-010813-FINAL1.pdf

Solomon-Cary, H. (2014). *Los Angeles Department of City Planning Report for Council File 13-1152, 13-1152-S1*. Department of City Planning. Retrieved from http://clkrep.lacity.org/online/docs/2013/13-1152-s1_rpt_plan_11-6-14.pdf

^{vi} Burwen, J., & Flegal, J. (2013). Case Studies on the Government's Role in Energy Technology Innovation: Unconventional Gas Exploration & Production. *American Energy Innovation Council*. Retrieved from <http://americanenergyinnovation.org/wp-content/uploads/2013/03/Case-Unconventional-Gas.pdf>; Jordan, P., & Heberger, M. (2014). Historic and Current Application of Well Stimulation Technology in California. California Council on Science and Technology. Retrieved from <http://www.ccst.us/publications/2014/2014wst3.pdf>

^{vii} What is Unconventional Oil and Gas? (n.d.). Retrieved from <http://www.aer.ca/about-aer/spotlight-on/unconventional-regulatory-framework/what-is-unconventional-oil-and-gas>

^{viii} What is Unconventional Oil and Gas? (n.d.). Retrieved from <http://www.aer.ca/about-aer/spotlight-on/unconventional-regulatory-framework/what-is-unconventional-oil-and-gas>

^{ix} Welcome to the Division of Oil, Gas & Geothermal Resources. (n.d.). Retrieved from <http://www.conservaion.ca.gov/dog/Pages/Index.aspx>

^x How Does Well Acidizing Work to Stimulate Production? (n.d.). Retrieved from https://www.rigzone.com/training/insight.asp?insight_id=320&c_id=4

^{xi} eTools | Oil and Gas Well Drilling and Servicing eTool - Glossary of Terms -. (n.d.). Retrieved November 25, 2014, from https://www.osha.gov/SLTC/etools/oilandgas/glossary_of_terms/glossary_of_terms_g.html; RIGZONE - How Does Well Completion Work? (n.d.). Retrieved November 25, 2014, from https://www.rigzone.com/training/insight.asp?i_id=326

^{xii} Eckerle, E., Kang, E., & Kobata, T. (2013). *Staff Report Proposed Rule 1148.2 – Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers*. South Coast Air Quality Management District. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148-2-staff-report.pdf?sfvrsn=4>. Page 71

^{xiii} Eckerle, E., Kang, E., & Kobata, T. (2013). *Staff Report Proposed Rule 1148.2 – Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers*. South Coast Air Quality Management District. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148-2-staff-report.pdf?sfvrsn=4>. Page 20

^{xiv} Eckerle, E., Kang, E., & Kobata, T. (2013). *Staff Report Proposed Rule 1148.2 – Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers*. South Coast Air Quality Management District. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148-2-staff-report.pdf?sfvrsn=4>. Page 20

^{xv} Air Quality Management District. (n.d.). *Update on Implementation of Rule 1148.2 (June 2014)*. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148.2-reports/r1148-2-june-2014-op-09-19-14-final.pdf?sfvrsn=4>

^{xvi} Hydrogen Sulfide. (n.d.). Retrieved from <https://www.osha.gov/SLTC/hydrogensulfide/>

Public Health Statement for Total Petroleum Hydrocarbons (TPH). (1999, September). Retrieved from <http://www.atsdr.cdc.gov/phs/phs.asp?id=422&tid=75>

Health Effects of Particulate Matter. (1997, July 17). Retrieved from <http://www.epa.gov/region7/air/quality/pmhealth.htm>

^{xvii} Air Quality Management District. (n.d.). *Update on Implementation of Rule 1148.2 (June 2014)*. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148.2-reports/r1148-2-june-2014-op-09-19-14-final.pdf?sfvrsn=4>; Air Quality Management District. (n.d.). *Summary of Implementation of Rule 1148.2 (June 2013–May 2014)*. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/draftfinalimpler1148-2-062014final.pdf?sfvrsn=2>

^{xviii} What is particulate matter? (n.d.). Retrieved from http://www.airinfonow.org/html/ed_particulate.html

U.S. Environmental Protection Agency. (1999). *Technical Bulletin Nitrogen Oxides (NOx), Why and How They Are Controlled*. Clean Air Technology Center. Retrieved from <http://www.epa.gov/ttn/catc1/dir1/fnoxdoc.pdf>

^{xix} Air Quality Management District. (n.d.). *Summary of Implementation of Rule 1148.2 (June 2013–May 2014)*. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/draftfinalimpler1148-2-062014final.pdf?sfvrsn=2>

Air Quality Management District. (n.d.). *Update on Implementation of Rule 1148.2 (June 2014)*. Retrieved from <http://www.aqmd.gov/docs/default-source/compliance/rule-1148.2-reports/r1148-2-june-2014-op-09-19-14-final.pdf?sfvrsn=4>

^{xx} Safety and Health Topics: Silica, Crystalline. (n.d.). Retrieved November 25, 2014, from <https://www.osha.gov/dsg/topics/silicacrystalline/>

^{xxi} Rancho Park Golf Course: 184 acres <http://www.lagolfclubs.com/clubs/NewHome.cfm/ClubID/29/Section/News/messid/546>; the recreation center is 40 acres <https://www.facebook.com/pages/Cheviot-Hills-Recreation-Center/188048331218924?sk=info>

^{xxii} Z.A. Case No. 19139; February 16, 1968

^{xxiii} From search of 1148.2 disclosure reports. Reports available for download at <http://xappprod.aqmd.gov/r1148pubaccessportal/>

^{xxiv} Sahagun, Louis. (2014, January 15). EPA accuses oil firm of endangering health of nearby residents. *Los Angeles Times*. Retrieved from <http://articles.latimes.com/2014/jan/15/local/la-me-0116-fumes-epa-20140116>

^{xxv} Sahagun, L. (2013, November 8). EPA officers sickened by fumes at South L.A. oil field. *Los Angeles Times*. Retrieved from <http://www.latimes.com/local/la-me-1109-fumes-20131109,0,3711063.story>; Sahagun, L. (2014, July 30). South L.A.'s Allenco fined \$99,000 over toxic emissions. *Los Angeles Times*. Retrieved from <http://www.latimes.com/science/la-me-0731-allenco-fine-20140731-story.html>

^{xxvi} Communities for a Better Environment. (2009). *Cumulative Impacts: Changing Regulatory Culture to Address Environmental Injustice & Environmental Racism*. Retrieved from <http://www.cbecal.org/wp-content/uploads/2012/05/Cululative-Impacts-report.pdf>

^{xxvii} Communities for a Better Environment. (2009). *Cumulative Impacts: Changing Regulatory Culture to Address Environmental Injustice & Environmental Racism*. Retrieved from <http://www.cbecal.org/wp-content/uploads/2012/05/Cululative-Impacts-report.pdf>